FIG. 1A

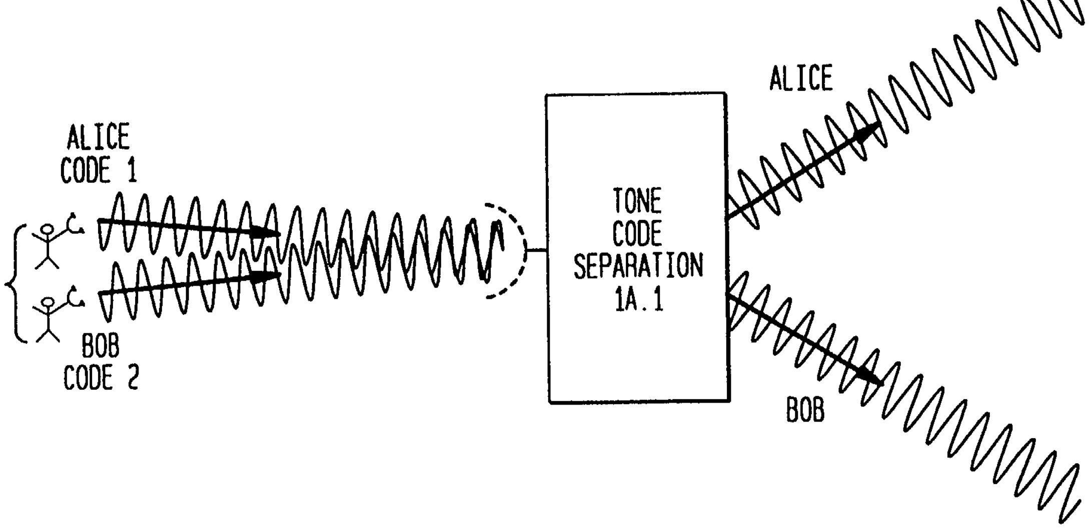


FIG. 1B

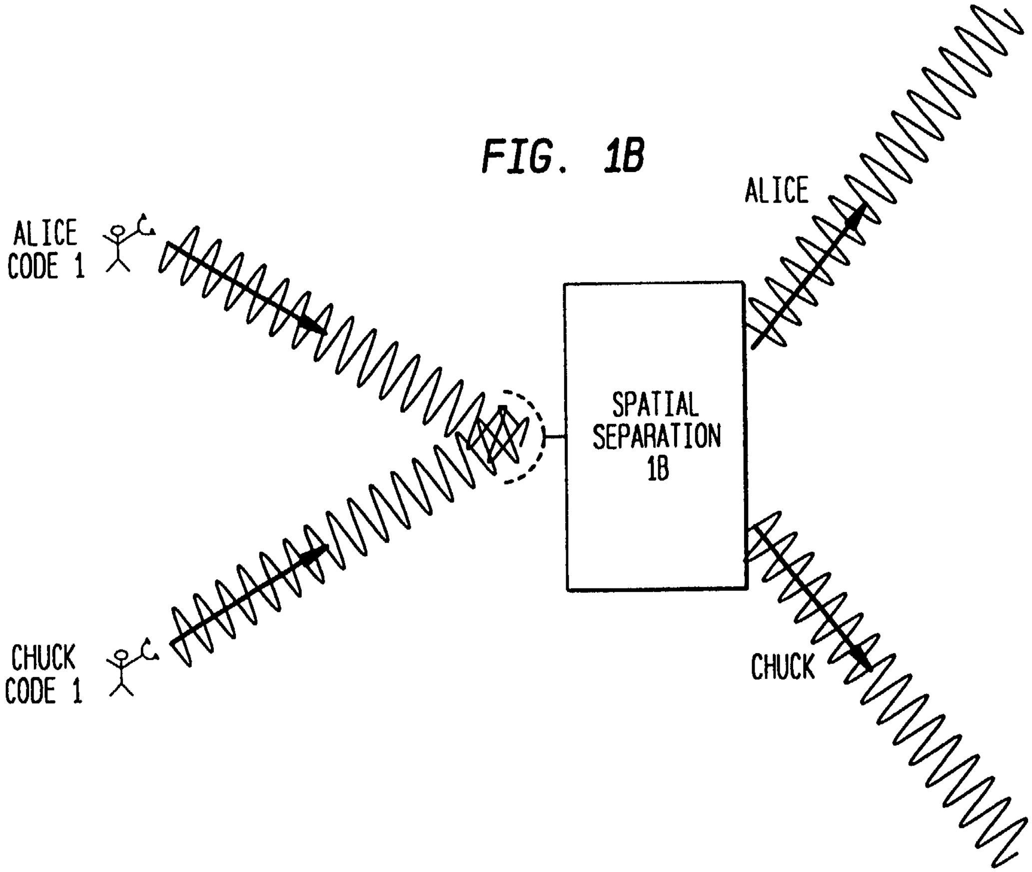


FIG. 1C

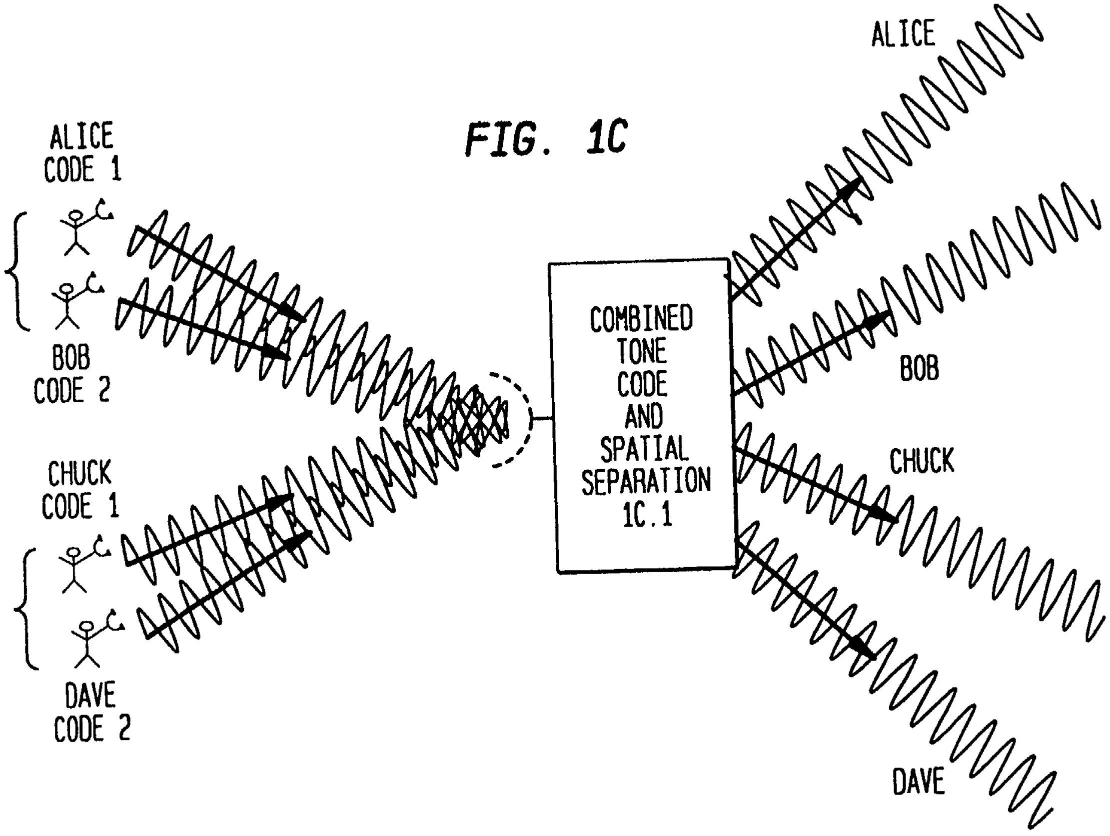

ALICE
CODE 1
BOB
CODE 2
CHUCK
CODE 1
DAVE
CODE 2
COMBINED
TONE
CODE
AND
SPATIAL
SEPARATION
1C.1
ALICE
BOB
CHUCK
DAVE

FIG. 1D

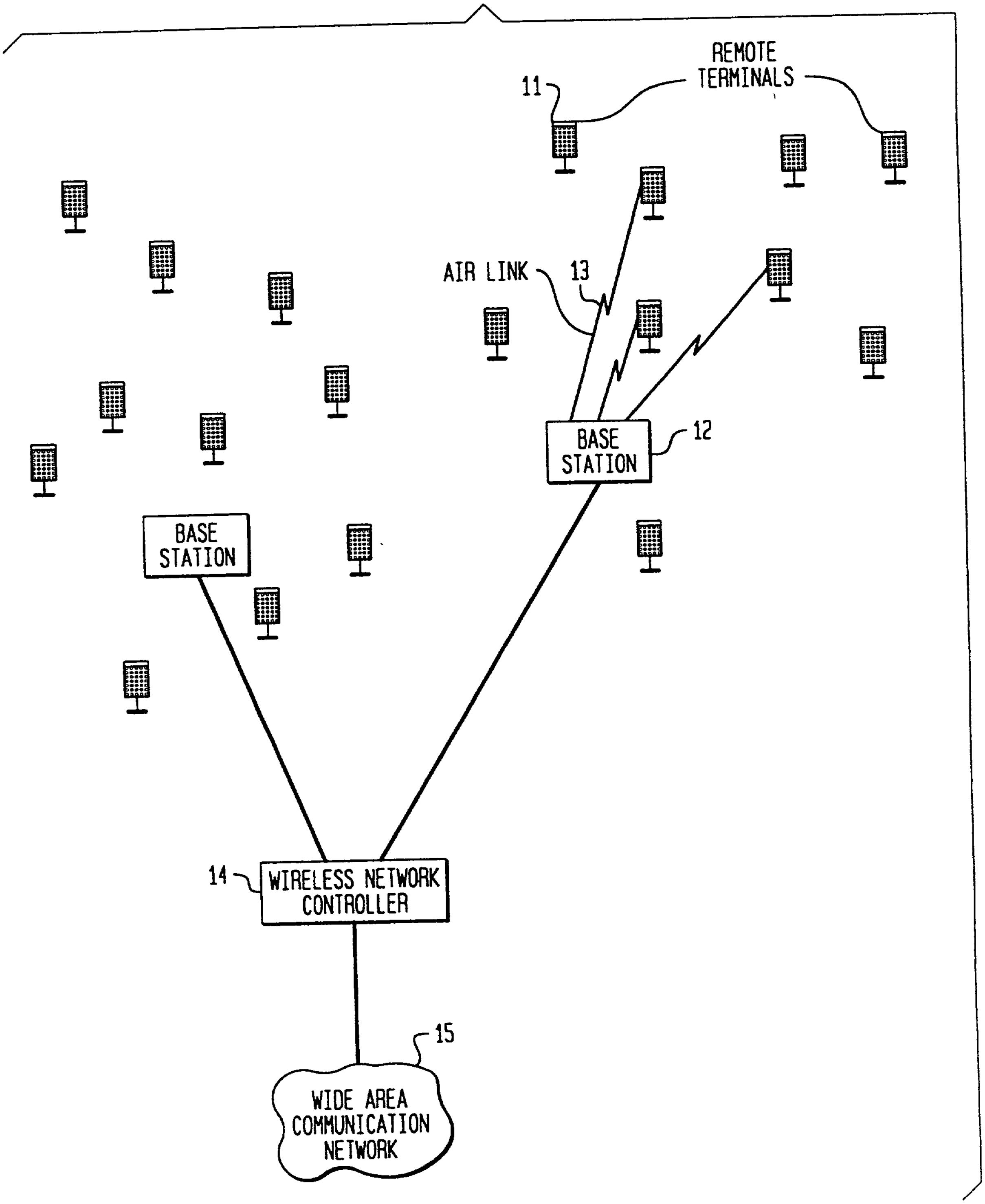

REMOTE TERMINALS
11
AIR LINK
13
BASE STATION
12
BASE STATION
14
WIRELESS NETWORK CONTROLLER
15
WIDE AREA COMMUNICATION NETWORK

FIG. 2

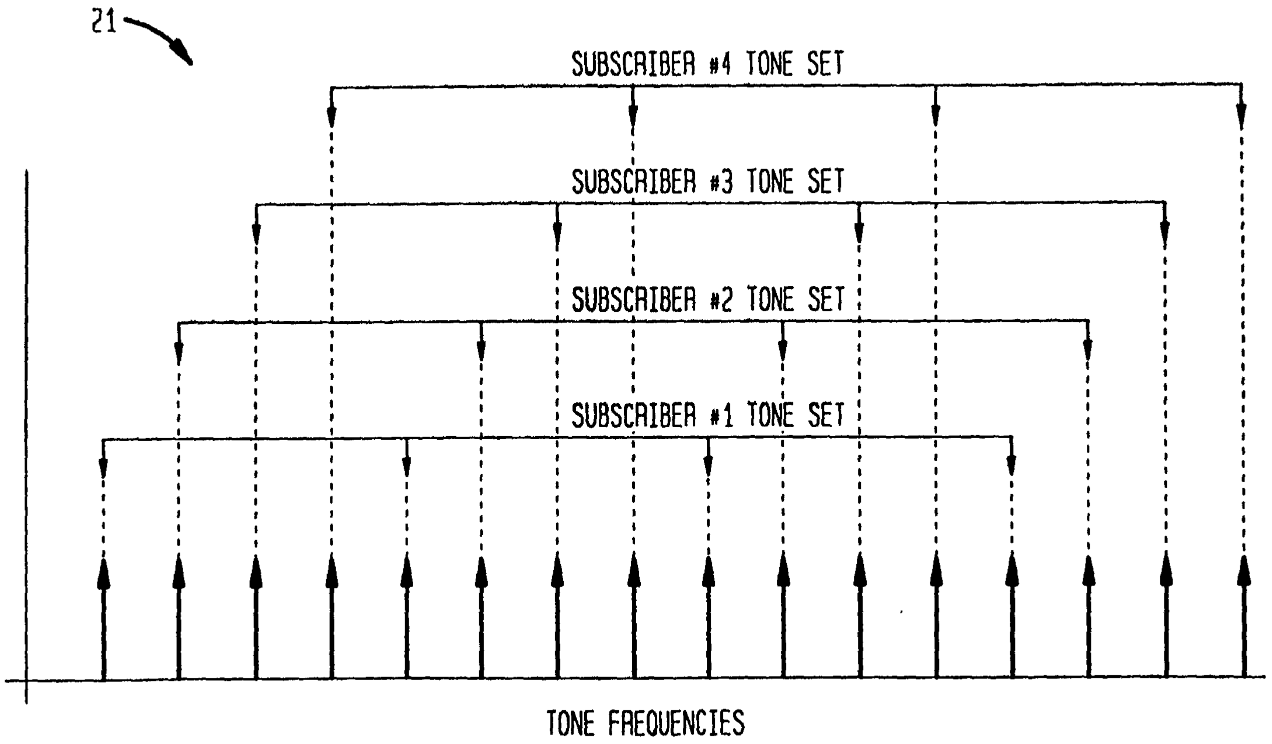

21
SUBSCRIBER #4 TONE SET
SUBSCRIBER #3 TONE SET
SUBSCRIBER #2 TONE SET
SUBSCRIBER #1 TONE SET
TONE FREQUENCIES

FIG. 3

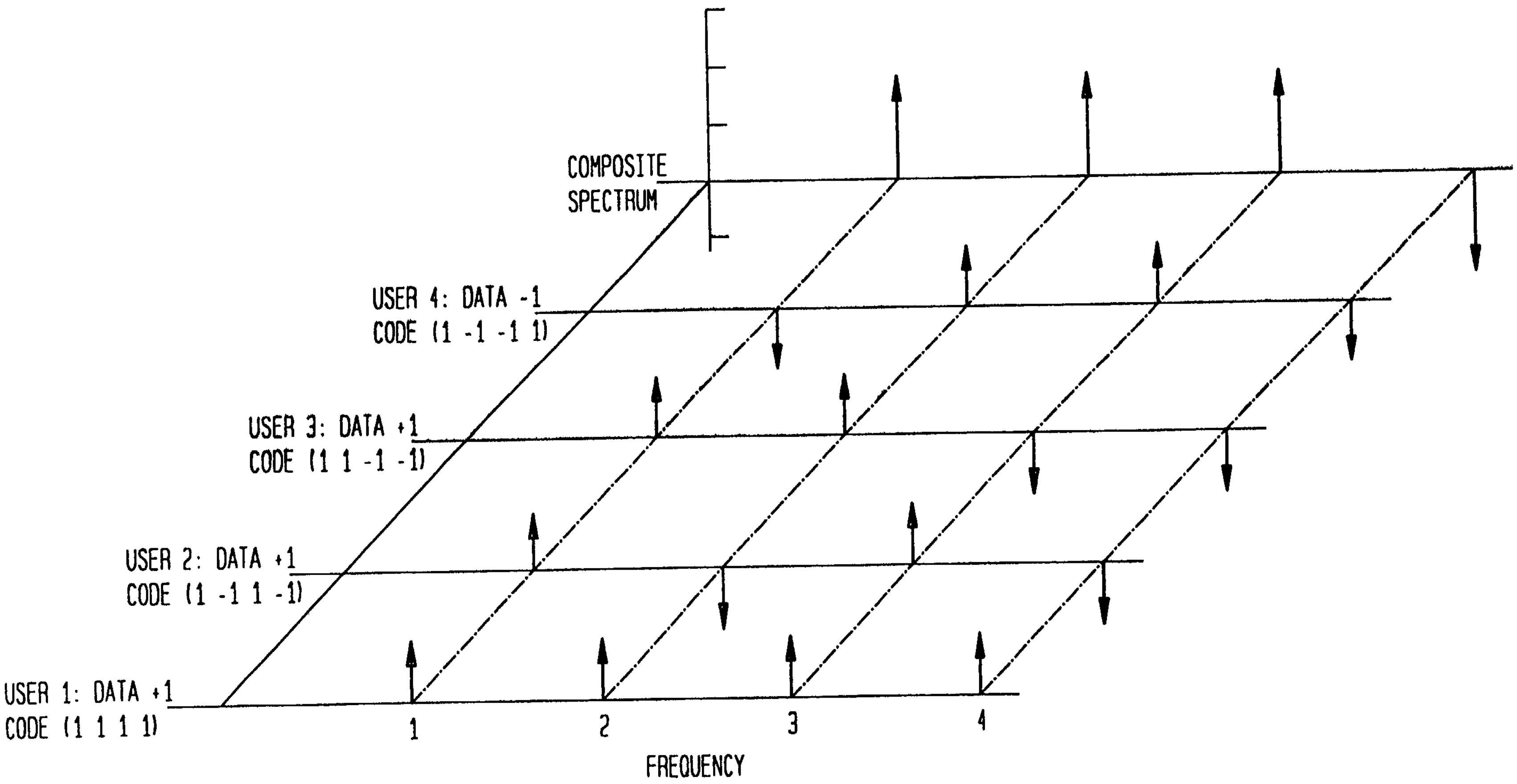
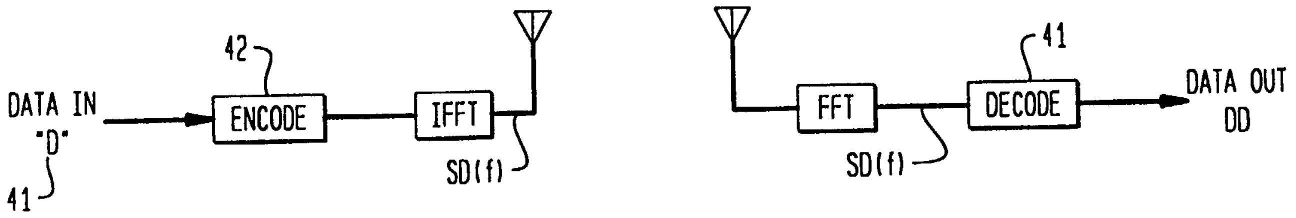

COMPOSITE
SPECTRUM
USER 4: DATA -1
CODE (1 -1 -1 1)
USER 3: DATA +1
CODE (1 1 -1 -1)
USER 2: DATA +1
CODE (1 -1 1 -1)
USER 1: DATA +1
CODE (1 1 1 1)
1
2
3
4
FREQUENCY

FIG. 4



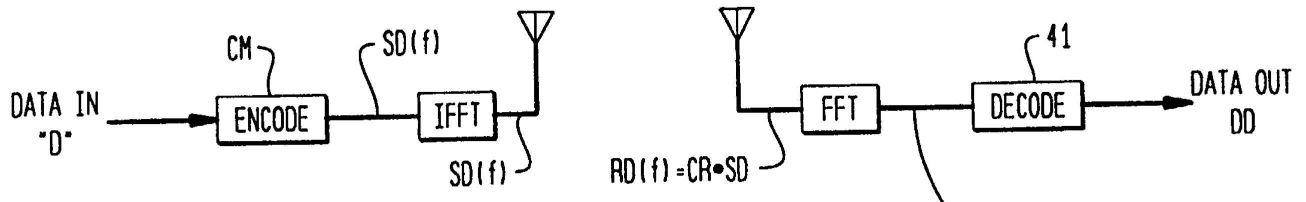
$$\overbrace{SD(f)=CM\bullet D}^{43}$$

$$SD(f)=\overset{47}{\begin{bmatrix}2\\2\\2\\-2\end{bmatrix}}=\overset{46}{\begin{bmatrix}1&1&1&1\\1&-1&1&-1\\1&1&-1&-1\\1&-1&-1&1\end{bmatrix}}\bullet\left.\overset{45}{\begin{bmatrix}1\\1\\1\\-1\end{bmatrix}}\right\}44$$

$$\overbrace{DD(f)=CM^{-1}\bullet SD(f)}^{60}$$

$$DD=\overset{51}{\begin{bmatrix}1\\1\\1\\-1\end{bmatrix}}=\frac{1}{4}\overset{50}{\begin{bmatrix}1&1&1&1\\1&-1&1&-1\\1&1&-1&-1\\1&-1&-1&1\end{bmatrix}}\bullet\left.\overset{49}{\begin{bmatrix}2\\2\\2\\-2\end{bmatrix}}\right\}48$$

FIG. 5



$$\overset{43}{\overbrace{SD(f)=CM\bullet D}}$$

$$\overset{52}{\overbrace{RD(f)=CR(f)\bullet SD(f)}}$$

$$RD=\overset{53}{\overbrace{\begin{bmatrix}0.9\\1.0\\1.2\\1.1\end{bmatrix}\bullet\begin{bmatrix}2\\2\\2\\-2\end{bmatrix}}}=\left.\begin{bmatrix}1&1&1&1\\1&-1&1&-1\\1&1&-1&-1\\1&-1&-1&1\end{bmatrix}\bullet\begin{bmatrix}1\\1\\1\\-1\end{bmatrix}\right\}44$$

$$DD=\begin{bmatrix}1.0\\1.1\\0.9\\-1.2\end{bmatrix}=\frac{1}{4}\begin{bmatrix}1&1&1&1\\1&-1&1&+1\\1&1&-1&-1\\1&-1&-1&1\end{bmatrix}\bullet\begin{bmatrix}1.8\\2.0\\2.4\\-2.2\end{bmatrix}$$

FIG. 6

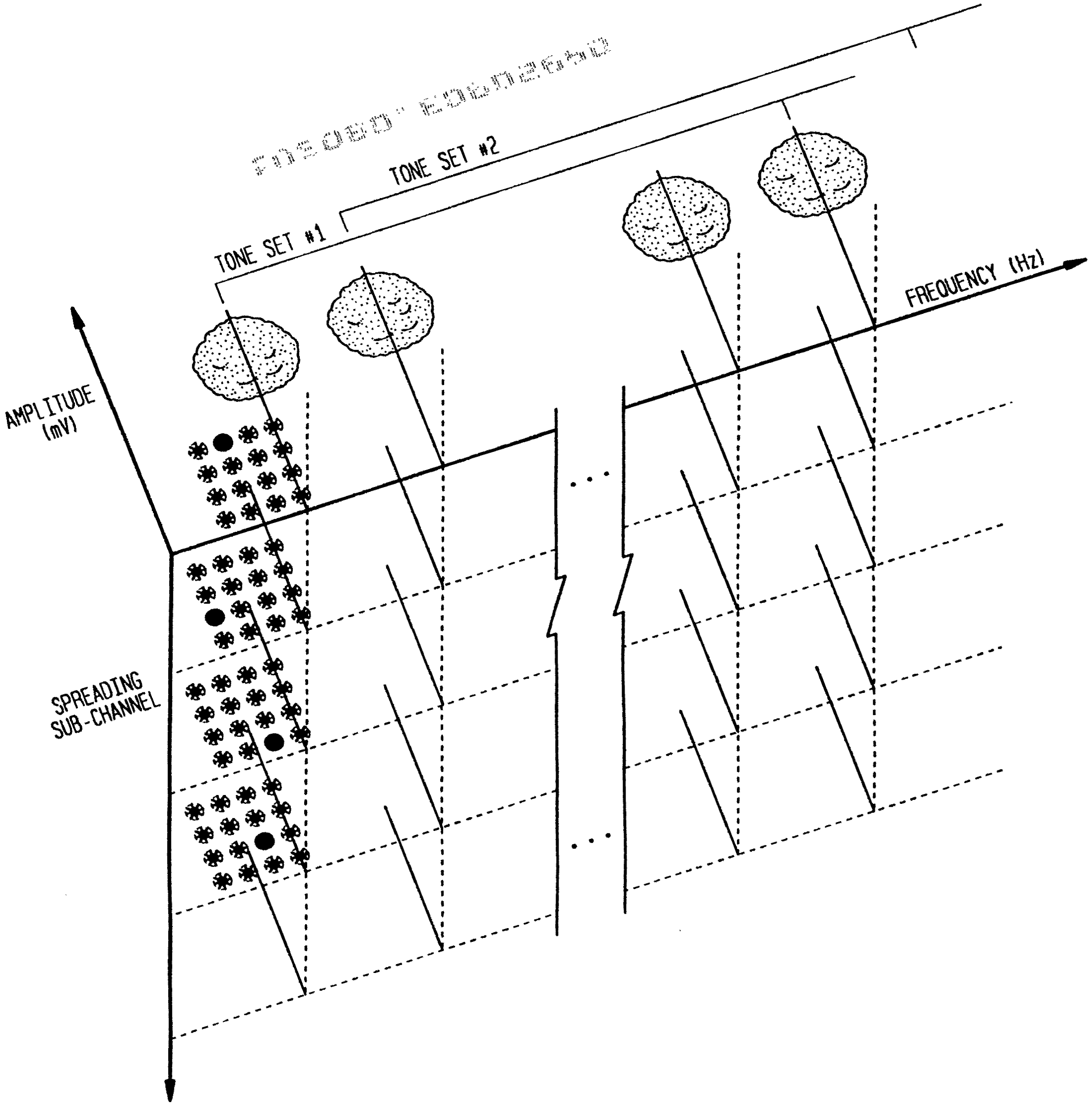

TONE SET #1
TONE SET #2
FREQUENCY (Hz)
AMPLITUDE (mV)
SPREADING SUB-CHANNEL
. . .
. . .

FIG. 7

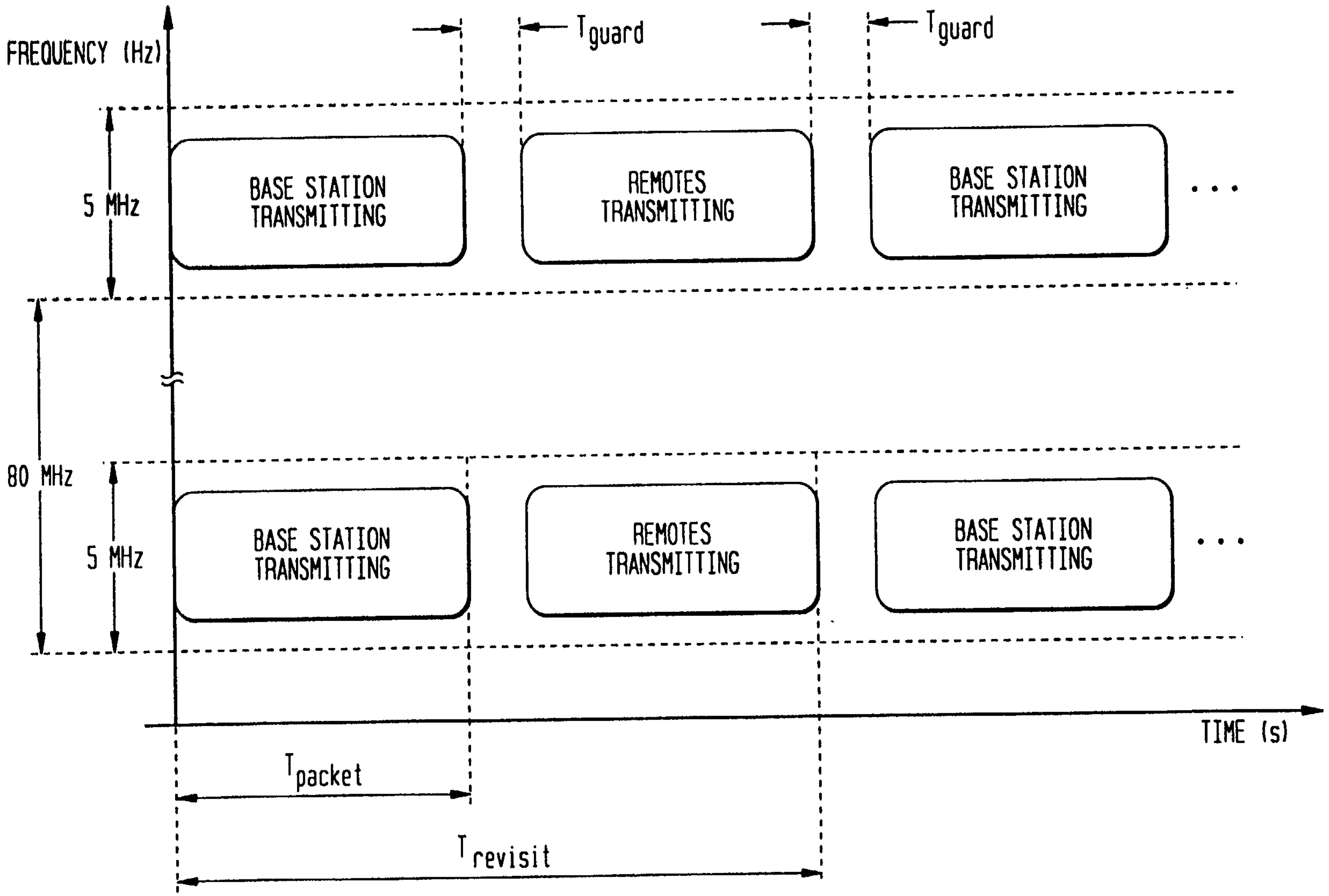

FREQUENCY (Hz)
T_{guard}
T_{guard}
5 MHz
80 MHz
5 MHz
BASE STATION TRANSMITTING
REMOTES TRANSMITTING
BASE STATION TRANSMITTING
...
BASE STATION TRANSMITTING
REMOTES TRANSMITTING
BASE STATION TRANSMITTING
...
TIME (s)
T_{packet}
$T_{revisit}$

FIG. 8

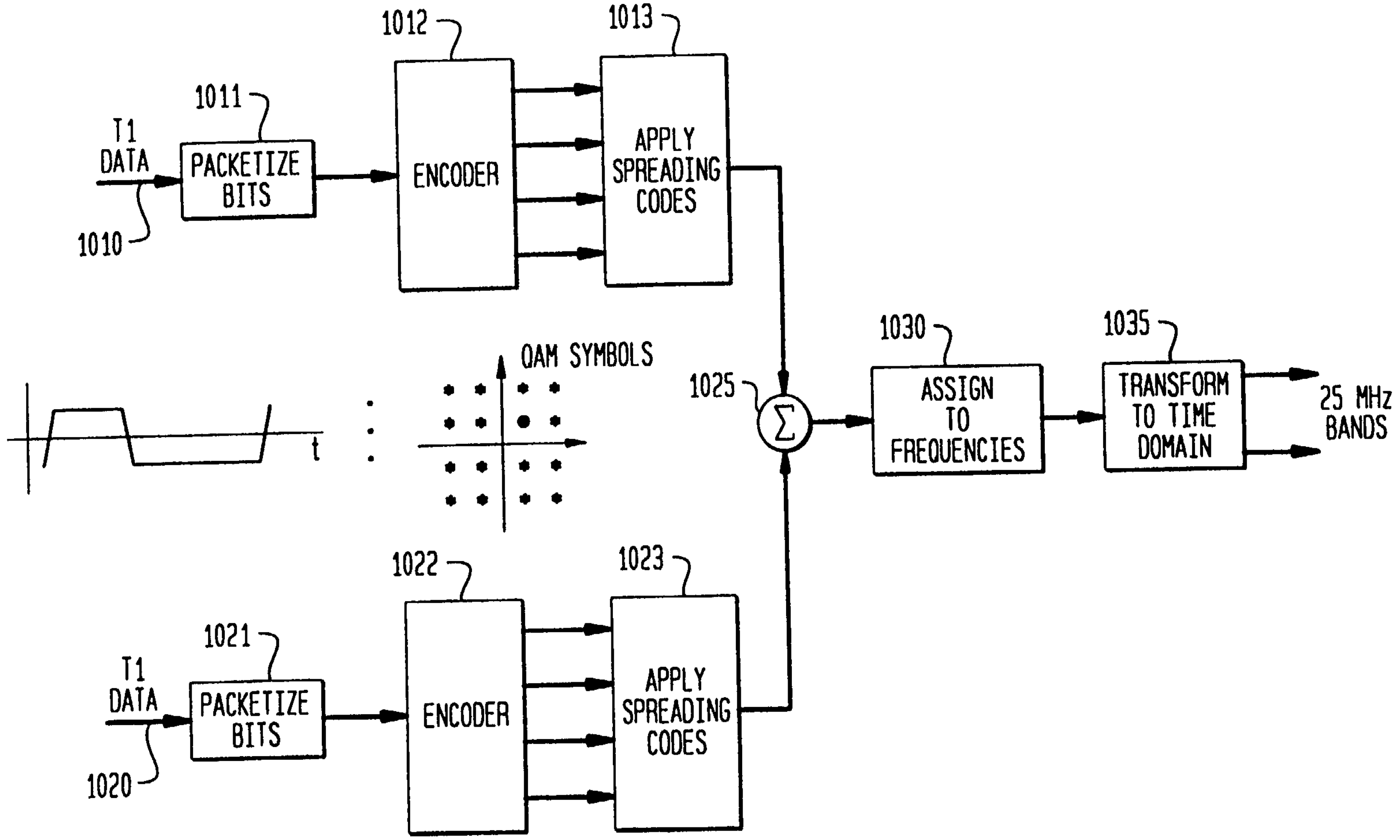
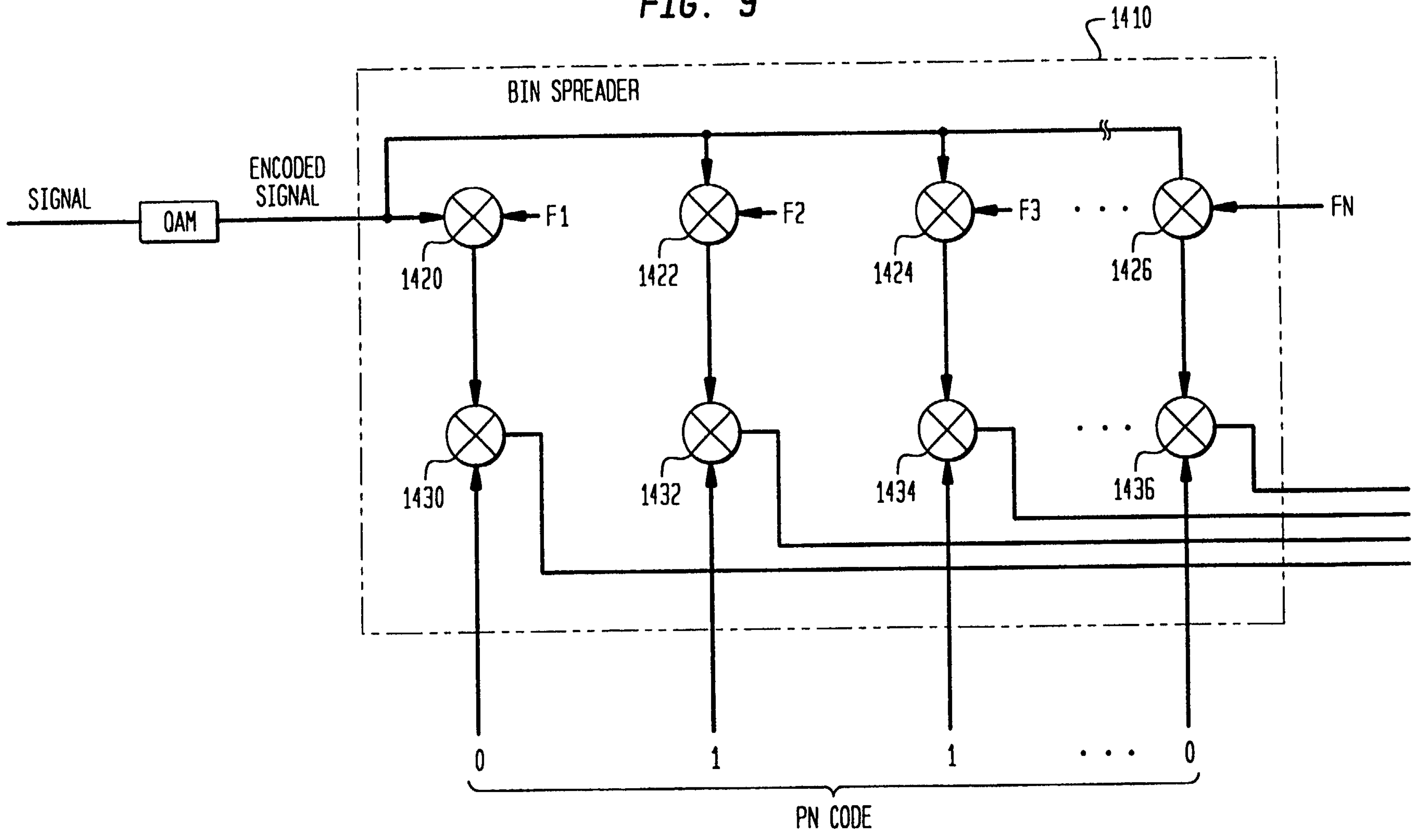

1010
T1
DATA
1011
PACKETIZE BITS
1012
ENCODER
1013
APPLY SPREADING CODES
t
QAM SYMBOLS
1020
T1
DATA
1021
PACKETIZE BITS
1022
ENCODER
1023
APPLY SPREADING CODES
1025
Σ
1030
ASSIGN TO FREQUENCIES
1035
TRANSFORM TO TIME DOMAIN
25 MHz BANDS

FIG. 9


1410
BIN SPREADER
SIGNAL
OAM
ENCODED SIGNAL
F1
F2
F3
FN
1420
1422
1424
1426
1430
1432
1434
1436
0
1
1
0
PN CODE

09920903.080301

FIG. 10

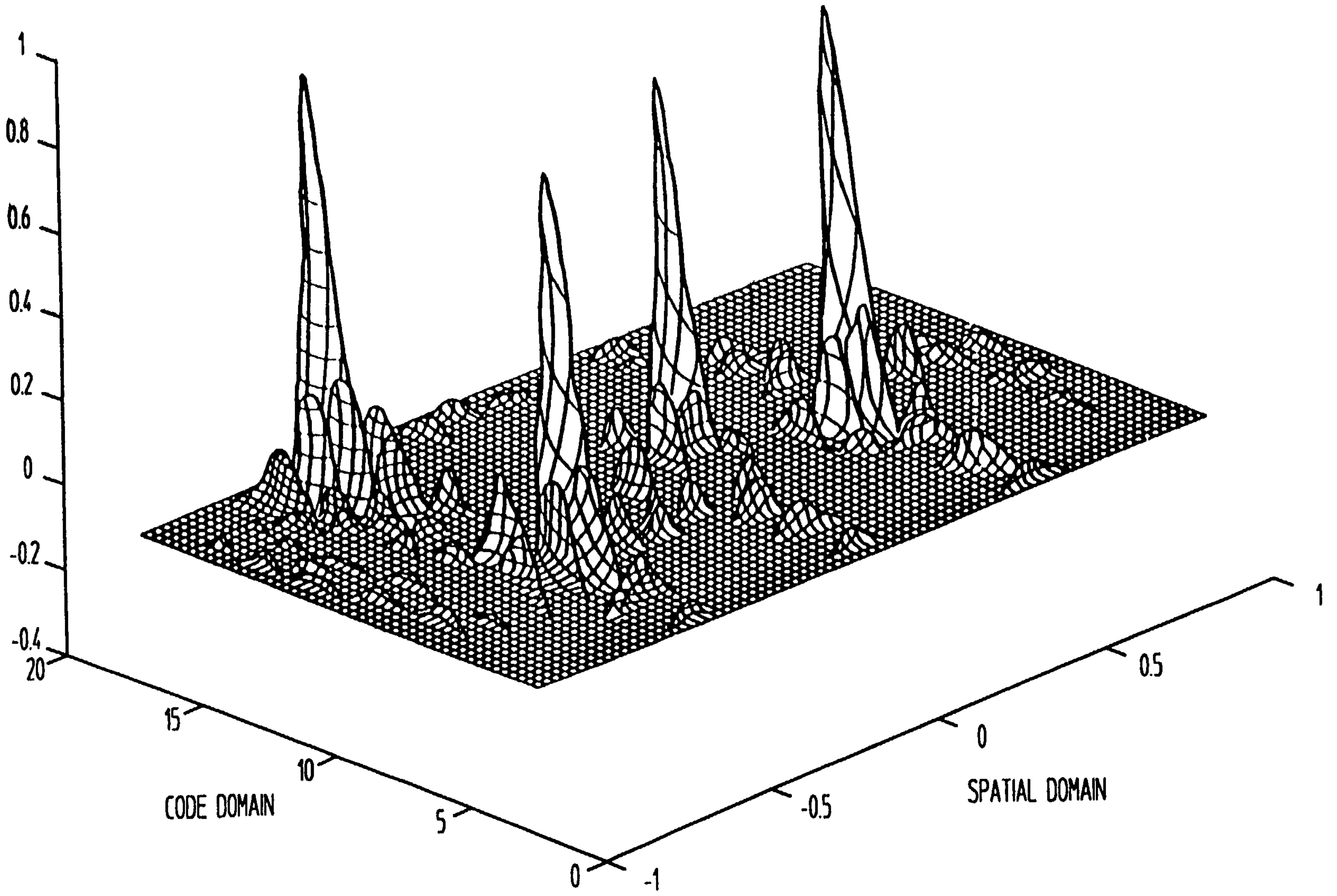


FIG. 11

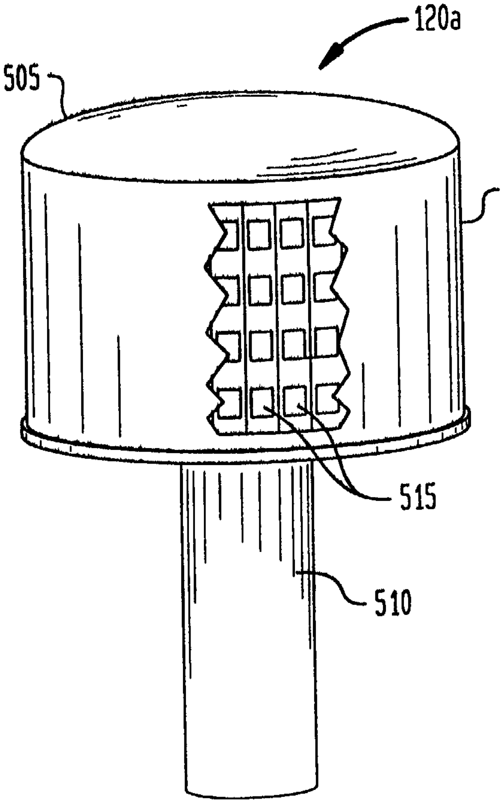


FIG. 12

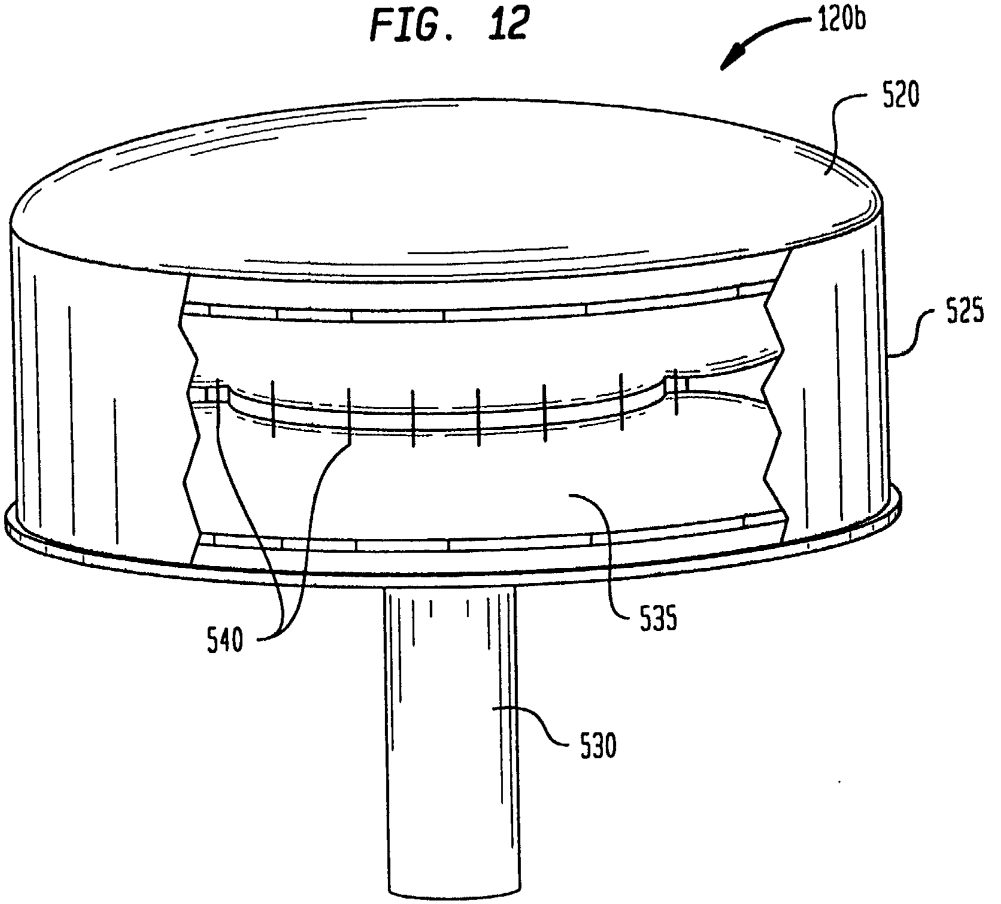


FIG. 13

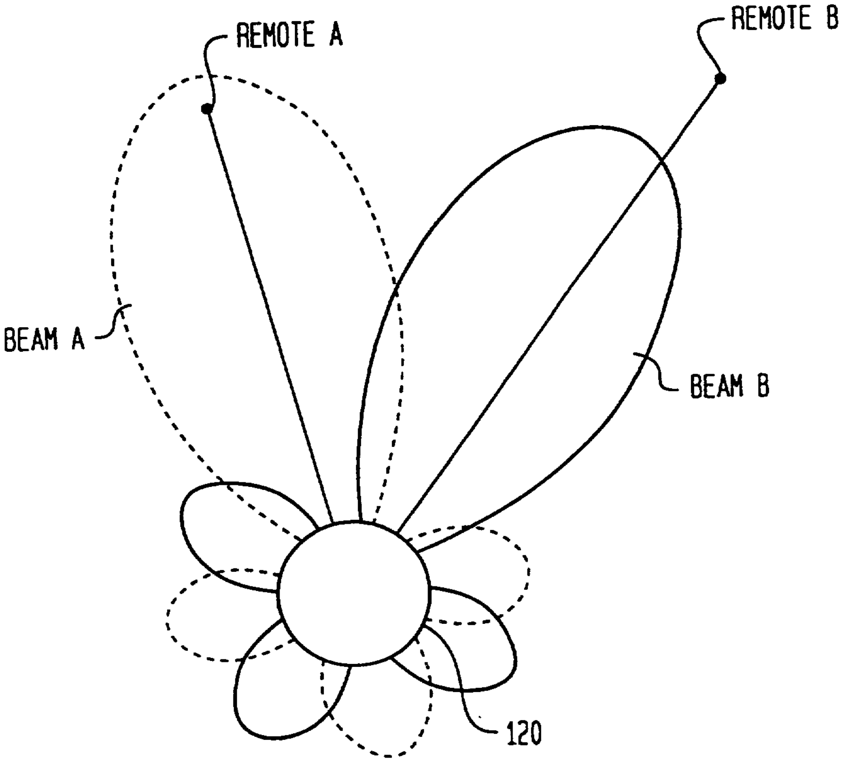


FIG. 14

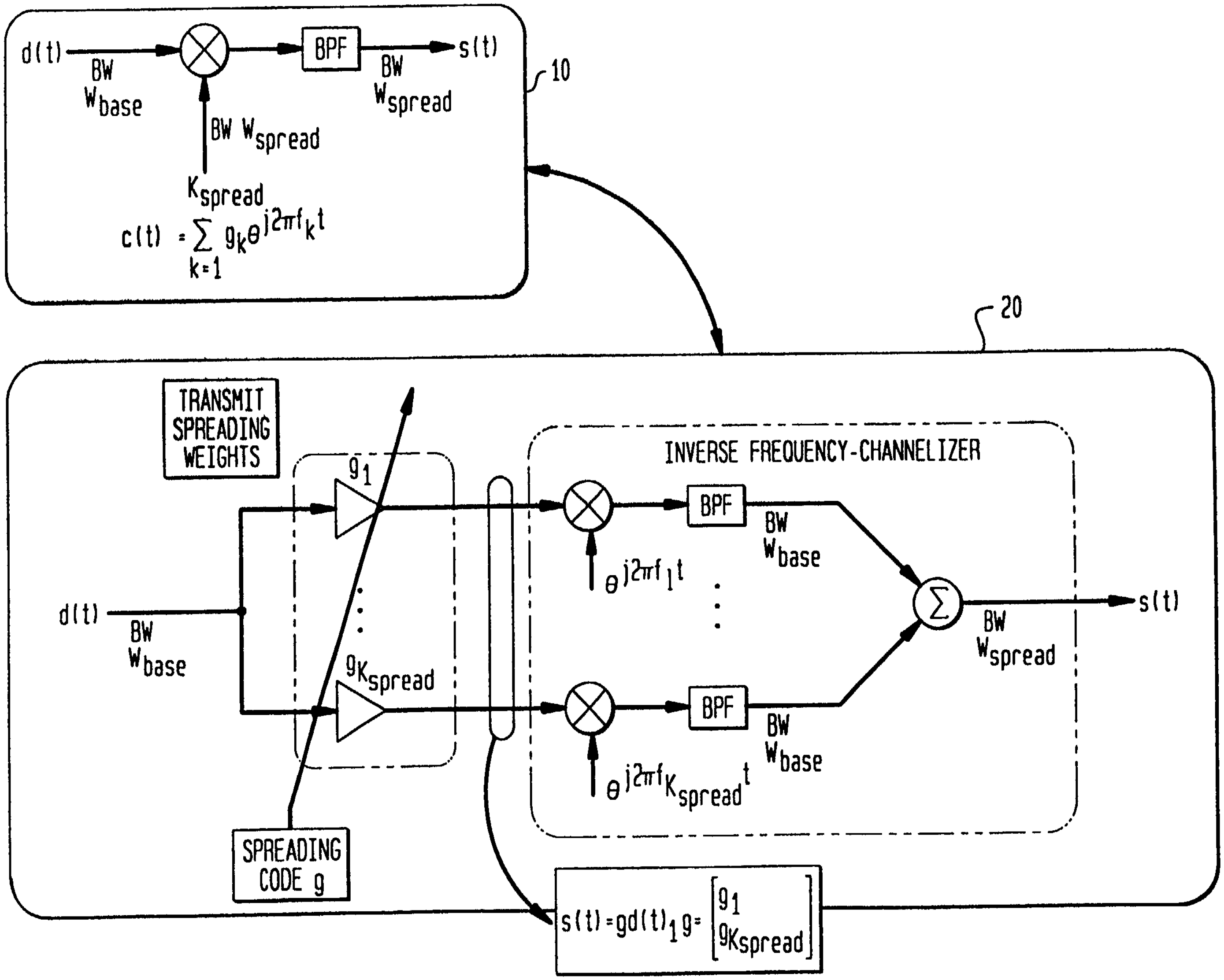

d(t)
BW
W_{base}
BPF
s(t)
BW
W_{spread}
BW W_{spread}
K_{spread}
$c(t) = \sum_{k=1} g_k e^{j2\pi f_k t}$
10
20
TRANSMIT SPREADING WEIGHTS
g_1
$g_{K_{spread}}$
SPREADING CODE g
INVERSE FREQUENCY-CHANNELIZER
$e^{j2\pi f_1 t}$
$e^{j2\pi f_{K_{spread}} t}$
BPF
BW
W_{base}
BPF
BW
W_{base}
Σ
BW
W_{spread}
s(t)
d(t)
BW
W_{base}
$s(t) = gd(t)_1 g = \begin{bmatrix} g_1 \\ g_{K_{spread}} \end{bmatrix}$

FIG. 15

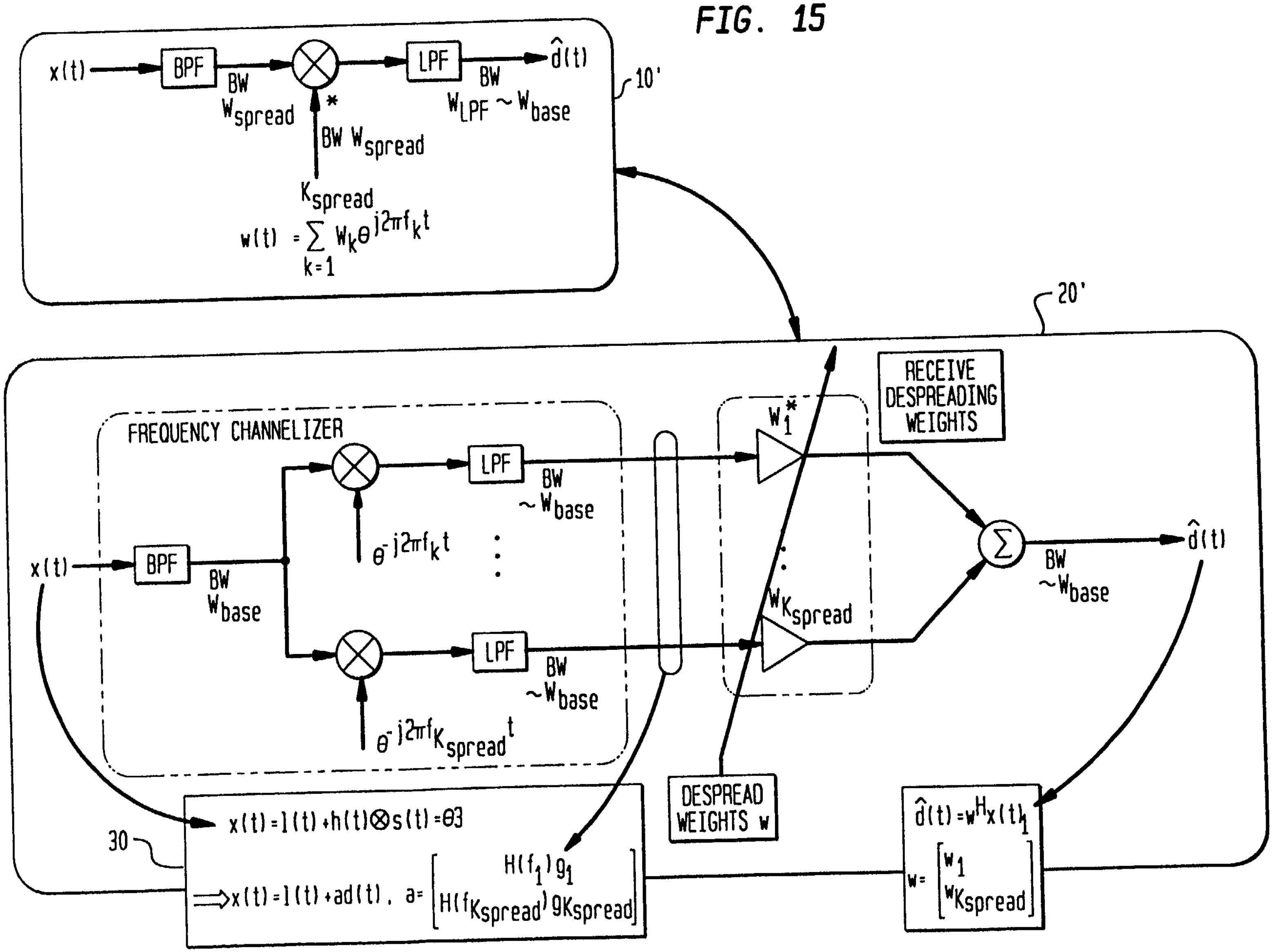

x(t)
BPF
BW
W_{spread}
*
BW W_{spread}
$w(t) = \sum_{k=1}^{K_{spread}} W_k e^{j2\pi f_k t}$
LPF
BW
$W_{LPF} \sim W_{base}$
$\hat{d}(t)$
10'
20'
FREQUENCY CHANNELIZER
x(t)
BPF
BW
W_{base}
$e^{-j2\pi f_k t}$
$e^{-j2\pi f_{K_{spread}} t}$
LPF
BW
$\sim W_{base}$
LPF
BW
$\sim W_{base}$
W_1^*
$W_{K_{spread}}$
RECEIVE DESPREADING WEIGHTS
DESPREAD WEIGHTS w
BW
$\sim W_{base}$
$\hat{d}(t)$
30
$x(t) = l(t) + h(t) \otimes s(t) = e3$
$\Longrightarrow x(t) = l(t) + a d(t),\ a = \begin{bmatrix} H(f_1) g_1 \\ H(f_{K_{spread}}) g_{K_{spread}} \end{bmatrix}$
$\hat{d}(t) = w^H x(t)$
$w = \begin{bmatrix} w_1 \\ w_{K_{spread}} \end{bmatrix}$

FIG. 16

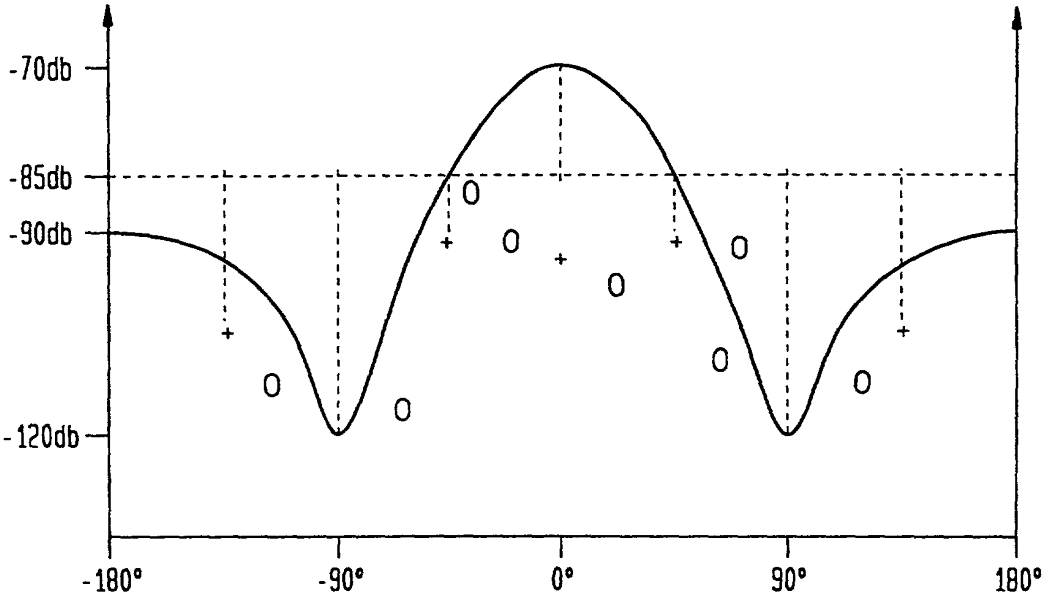


FIG. 17

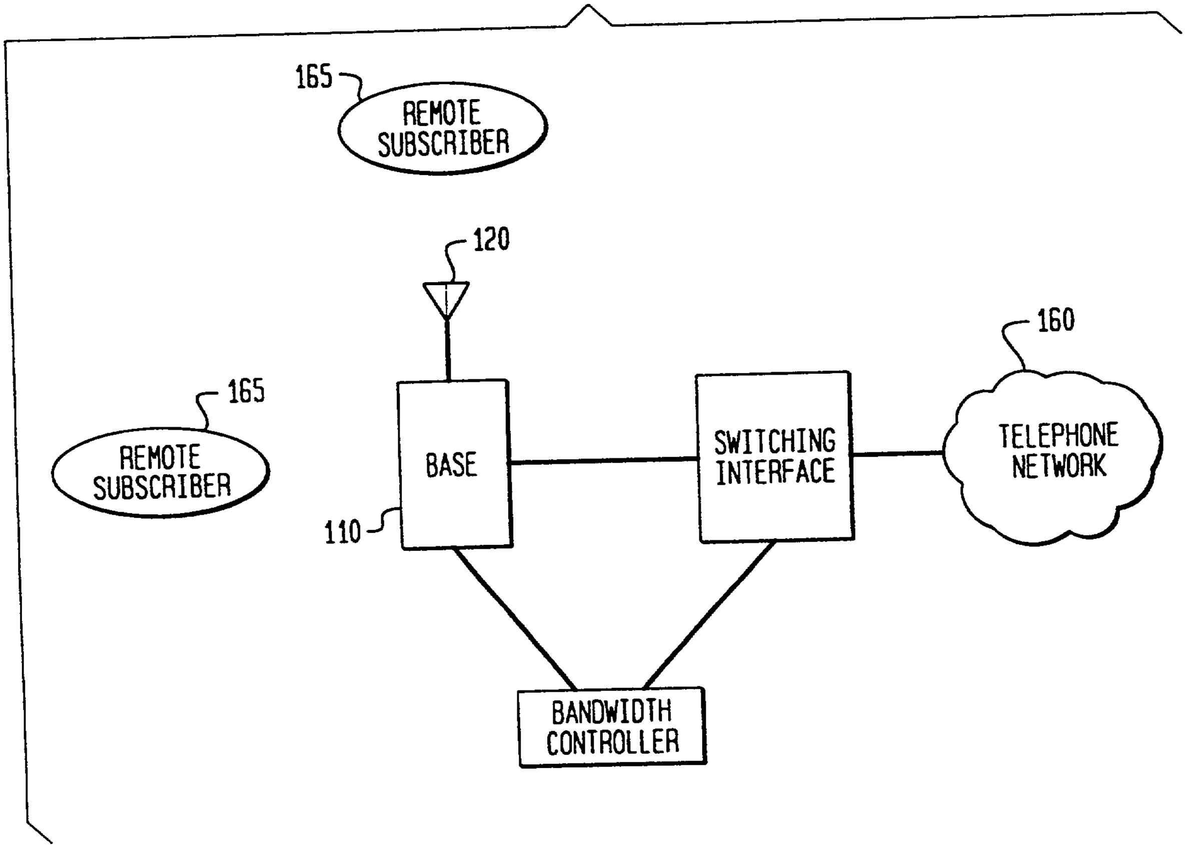

165
REMOTE SUBSCRIBER
120
160
165
REMOTE SUBSCRIBER
BASE
110
SWITCHING INTERFACE
TELEPHONE NETWORK
BANDWIDTH CONTROLLER

FIG. 18

BASE FREQUENCY	LOWER RF BAND	UPPER RF BAND
1850 MHz	1850-1855 MHz	1930-1935 MHz
1855 MHz	1855-1860 MHz	1935-1940 MHz
1860 MHz	1860-1865 MHz	1940-1945 MHz
1865 MHz	1865-1870 MHz	1945-1950 MHz
1870 MHz	1870-1875 MHz	1950-1955 MHz
1875 MHz	1875-1880 MHz	1955-1960 MHz
1880 MHz	1880-1885 MHz	1960-1965 MHz
1885 MHz	1885-1890 MHz	1965-1970 MHz
1890 MHz	1890-1895 MHz	1970-1975 MHz
1895 MHz	1895-1900 MHz	1975-1980 MHz
1900 MHz	1900-1905 MHz	1980-1985 MHz
1905 MHz	1905-1910 MHz	1985-1990 MHz

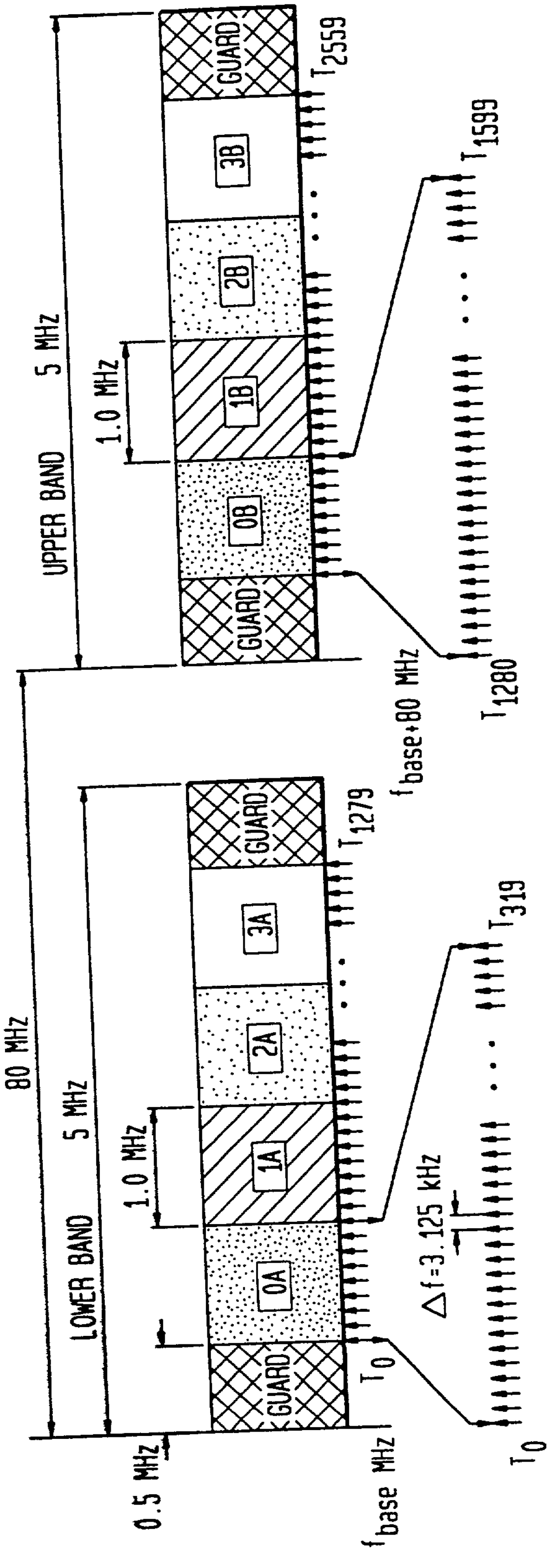

80 MHz
LOWER BAND
5 MHz
UPPER BAND
5 MHz
1.0 MHz
1.0 MHz
0.5 MHz
GUARD
0A
1A
2A
3A
GUARD
GUARD
0B
1B
2B
3B
GUARD
T_0
T_{1279}
T_{1280}
T_{2559}
T_0
T_{319}
T_{1280}
T_{1599}
$\Delta f=3.125$ kHz
f_{base} MHz
$f_{base+80}$ MHz

FIG. 19

FIG. 20

SUBBAND PAIR DESIGNATION		TONES
SUBBAND PAIR 0	0 A	$\{T_0, T_1, \ldots, T_{319}\}$
	0 B	$\{T_{1280}, T_{1281}, \ldots, T_{1599}\}$
SUBBAND PAIR 1	1 A	$\{T_{320}, T_{321}, \ldots, T_{639}\}$
	1 B	$\{T_{1600}, T_{1601}, \ldots, T_{1919}\}$
SUBBAND PAIR 2	2 A	$\{T_{640}, T_{641}, \ldots, T_{959}\}$
	2 B	$\{T_{1920}, T_{1921}, \ldots, T_{2239}\}$
SUBBAND PAIR 3	3 A	$\{T_{960}, T_{961}, \ldots, T_{1279}\}$
	3 B	$\{T_{2240}, T_{2241}, \ldots, T_{2559}\}$

FIG. 21

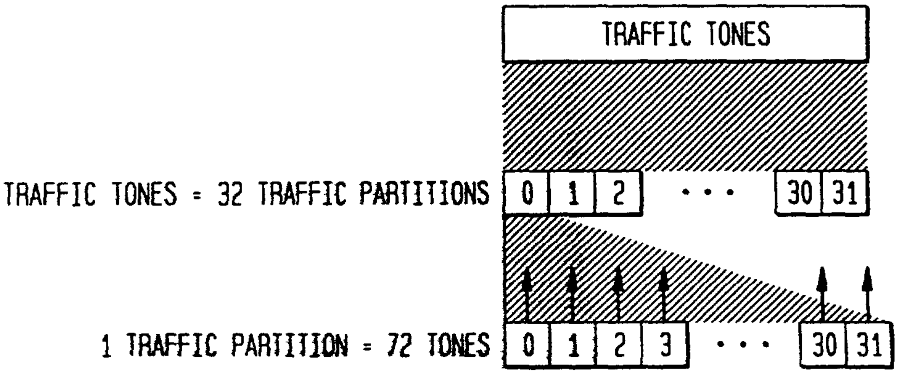


FIG. 22

TONE INDEX	TONE	TONE INDEX	TONE	TONE INDEX	TONE	TONE INDEX	TONE
$P_i(0)$	T_{20i+1}	$P_i(18)$	$T_{20i+161}$	$P_i(36)$	$T_{20i+1281}$	$P_i(54)$	$T_{20i+1441}$
$P_i(1)$	T_{20i+2}	$P_i(19)$	$T_{20i+162}$	$P_i(37)$	$T_{20i+1282}$	$P_i(55)$	$T_{20i+1442}$
$P_i(2)$	T_{20i+3}	$P_i(20)$	$T_{20i+163}$	$P_i(38)$	$T_{20i+1283}$	$P_i(56)$	$T_{20i+1443}$
$P_i(3)$	T_{20i+4}	$P_i(21)$	$T_{20i+164}$	$P_i(39)$	$T_{20i+1284}$	$P_i(57)$	$T_{20i+1444}$
$P_i(4)$	T_{20i+5}	$P_i(22)$	$T_{20i+165}$	$P_i(40)$	$T_{20i+1285}$	$P_i(58)$	$T_{20i+1445}$
$P_i(5)$	T_{20i+6}	$P_i(23)$	$T_{20i+166}$	$P_i(41)$	$T_{20i+1286}$	$P_i(59)$	$T_{20i+1446}$
$P_i(6)$	T_{20i+7}	$P_i(24)$	$T_{20i+167}$	$P_i(42)$	$T_{20i+1287}$	$P_i(60)$	$T_{20i+1447}$
$P_i(7)$	T_{20i+8}	$P_i(25)$	$T_{20i+168}$	$P_i(43)$	$T_{20i+1288}$	$P_i(61)$	$T_{20i+1448}$
$P_i(8)$	T_{20i+9}	$P_i(26)$	$T_{20i+169}$	$P_i(44)$	$T_{20i+1289}$	$P_i(62)$	$T_{20i+1449}$
$P_i(9)$	T_{20i+11}	$P_i(27)$	$T_{20i+171}$	$P_i(45)$	$T_{20i+1291}$	$P_i(63)$	$T_{20i+1451}$
$P_i(10)$	T_{20i+12}	$P_i(28)$	$T_{20i+172}$	$P_i(46)$	$T_{20i+1292}$	$P_i(64)$	$T_{20i+1452}$
$P_i(11)$	T_{20i+13}	$P_i(29)$	$T_{20i+173}$	$P_i(47)$	$T_{20i+1293}$	$P_i(65)$	$T_{20i+1453}$
$P_i(12)$	T_{20i+14}	$P_i(30)$	$T_{20i+174}$	$P_i(48)$	$T_{20i+1294}$	$P_i(66)$	$T_{20i+1454}$
$P_i(13)$	T_{20i+15}	$P_i(31)$	$T_{20i+175}$	$P_i(49)$	$T_{20i+1295}$	$P_i(67)$	$T_{20i+1455}$
$P_i(14)$	T_{20i+16}	$P_i(32)$	$T_{20i+176}$	$P_i(50)$	$T_{20i+1296}$	$P_i(68)$	$T_{20i+1456}$
$P_i(15)$	T_{20i+17}	$P_i(33)$	$T_{20i+177}$	$P_i(51)$	$T_{20i+1297}$	$P_i(69)$	$T_{20i+1457}$
$P_i(16)$	T_{20i+18}	$P_i(34)$	$T_{20i+178}$	$P_i(52)$	$T_{20i+1298}$	$P_i(70)$	$T_{20i+1458}$
$P_i(17)$	T_{20i+19}	$P_i(35)$	$T_{20i+179}$	$P_i(53)$	$T_{20i+1299}$	$P_i(71)$	$T_{20i+1459}$

FIG. 23

TONES ALLOCATED TO CLC/CAC IN SUBBAND PAIR i ($CLC_i/CAC_{i,0}$)

INDEX	TONE	INDEX	TONE	INDEX	TONE	INDEX	TONE
0	T_{320i}	1	$T_{320i+20}$	2	$T_{320i+40}$	3	$T_{320i+60}$
4	$T_{320i+160}$	5	$T_{320i+180}$	6	$T_{320i+200}$	7	$T_{320i+220}$
8	$T_{320i+1280}$	9	$T_{320i+1300}$	10	$T_{320i+1320}$	11	$T_{320i+1340}$
12	$T_{320i+1440}$	13	$T_{320i+1460}$	14	$T_{320i+1480}$	15	$T_{320i+1500}$

TONES ALLOCATED TO BRC/CAC IN SUBBAND PAIR i ($BRC_i/CAC_{i,9}$)

INDEX	TONE	INDEX	TONE	INDEX	TONE	INDEX	TONE
0	$T_{320i+90}$	1	$T_{320i+110}$	2	$T_{320i+130}$	3	$T_{320i+150}$
4	$T_{320i+250}$	5	$T_{320i+270}$	6	$T_{320i+290}$	7	$T_{320i+310}$
8	$T_{320i+1370}$	9	$T_{320i+1390}$	10	$T_{320i+1410}$	11	$T_{320i+1430}$
12	$T_{320i+1530}$	13	$T_{320i+1550}$	14	$T_{320i+1570}$	15	$T_{320i+1590}$

TONES ALLOCATED TO RSC/DCC IN SUBBAND PAIR i (RSC_i/DCC_i)

INDEX	TONE	INDEX	TONE	INDEX	TONE	INDEX	TONE
0	$T_{320i+10}$	1	$T_{320i+20}$	2	$T_{320i+50}$	3	$T_{320i+70}$
4	$T_{320i+80}$	5	$T_{320i+100}$	6	$T_{320i+120}$	7	$T_{320i+140}$
8	$T_{320i+170}$	9	$T_{320i+190}$	10	$T_{320i+210}$	11	$T_{320i+230}$
12	$T_{320i+240}$	13	$T_{320i+260}$	14	$T_{320i+280}$	15	$T_{320i+300}$
16	$T_{320i+1290}$	17	$T_{320i+1310}$	18	$T_{320i+1330}$	19	$T_{320i+1350}$
20	$T_{320i+1360}$	21	$T_{320i+1380}$	22	$T_{320i+1400}$	23	$T_{320i+1420}$
24	$T_{320i+1450}$	25	$T_{320i+1470}$	26	$T_{320i+1490}$	27	$T_{320i+1510}$
28	$T_{320i+1520}$	29	$T_{320i+1540}$	30	$T_{320i+1560}$	31	$T_{320i+1580}$

FIG. 24

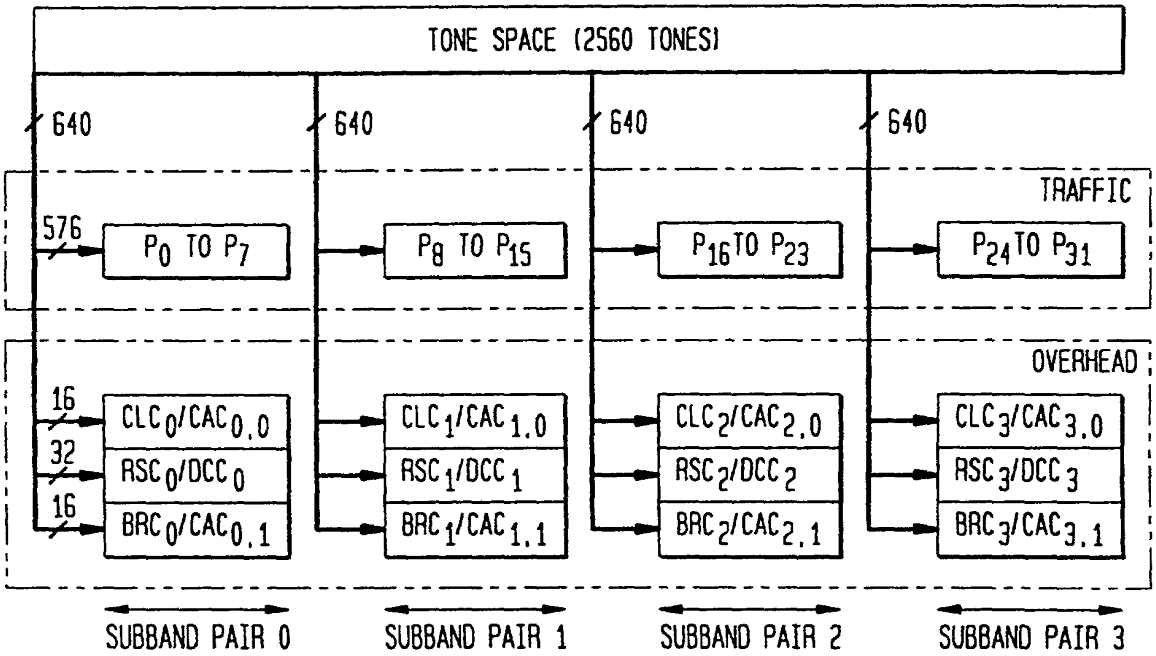
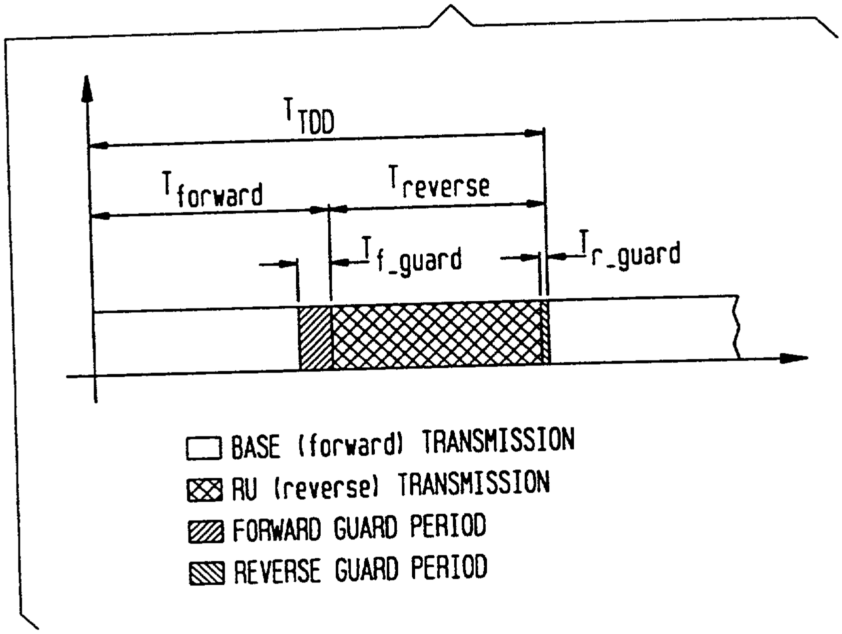
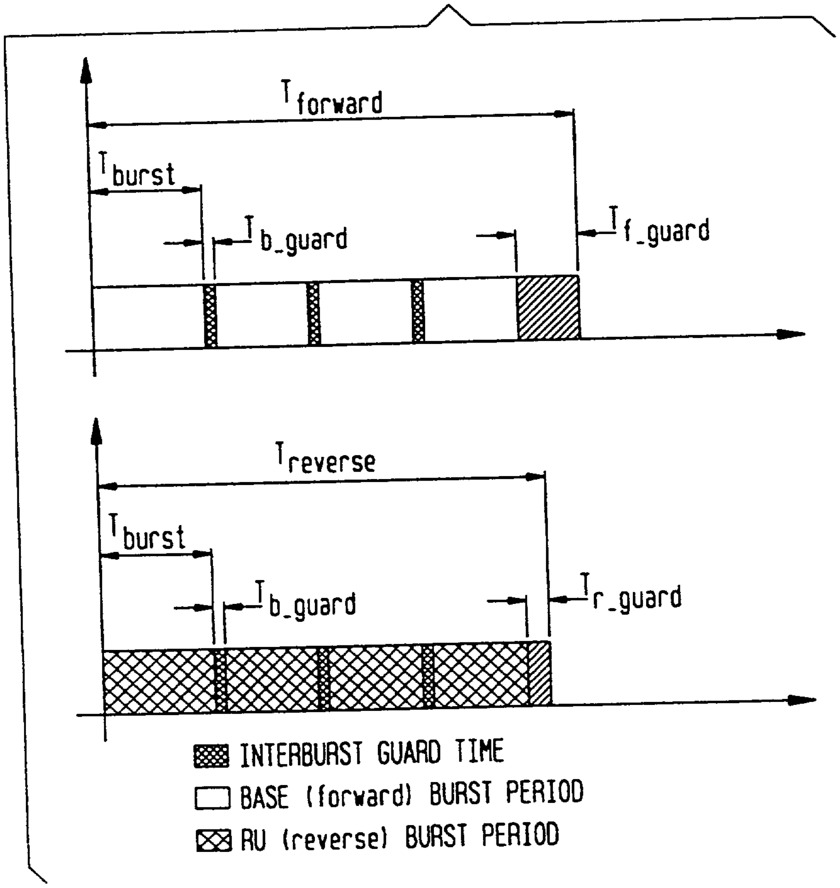

TONE SPACE (2560 TONES)
640
640
640
640
TRAFFIC
576
P_0 TO P_7
P_8 TO P_{15}
P_{16} TO P_{23}
P_{24} TO P_{31}
OVERHEAD
16
32
16
$CLC_0/CAC_{0,0}$
RSC_0/DCC_0
$BRC_0/CAC_{0,1}$
$CLC_1/CAC_{1,0}$
RSC_1/DCC_1
$BRC_1/CAC_{1,1}$
$CLC_2/CAC_{2,0}$
RSC_2/DCC_2
$BRC_2/CAC_{2,1}$
$CLC_3/CAC_{3,0}$
RSC_3/DCC_3
$BRC_3/CAC_{3,1}$
SUBBAND PAIR 0
SUBBAND PAIR 1
SUBBAND PAIR 2
SUBBAND PAIR 3

FIG. 25



T_{TDD}
$T_{forward}$
$T_{reverse}$
T_{f_guard}
T_{r_guard}
☐ BASE (forward) TRANSMISSION
☒ RU (reverse) TRANSMISSION
▨ FORWARD GUARD PERIOD
▧ REVERSE GUARD PERIOD

FIG. 26



$T_{forward}$
T_{burst}
T_{b_guard}
T_{f_guard}
$T_{reverse}$
T_{burst}
T_{b_guard}
T_{r_guard}
▩ INTERBURST GUARD TIME
☐ BASE (forward) BURST PERIOD
☒ RU (reverse) BURST PERIOD

FIG. 27

TDD PARAMETER	VALUE (μs)
$T_{forward}$	1610
$T_{reverse}$	1390
T_{f_guard}	255
T_{r_guard}	35
$T_{revisit}$	3000
T_{burst}	320
T_{b_guard}	25

FIG. 28

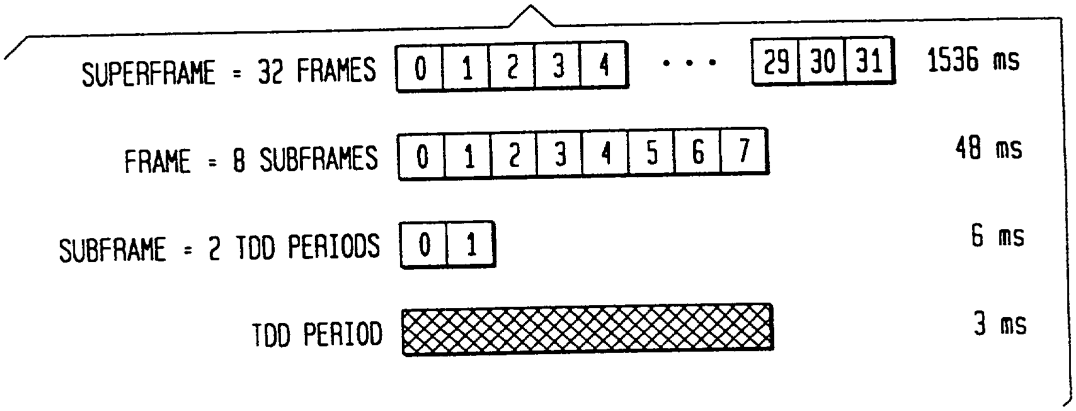


FIG. 29

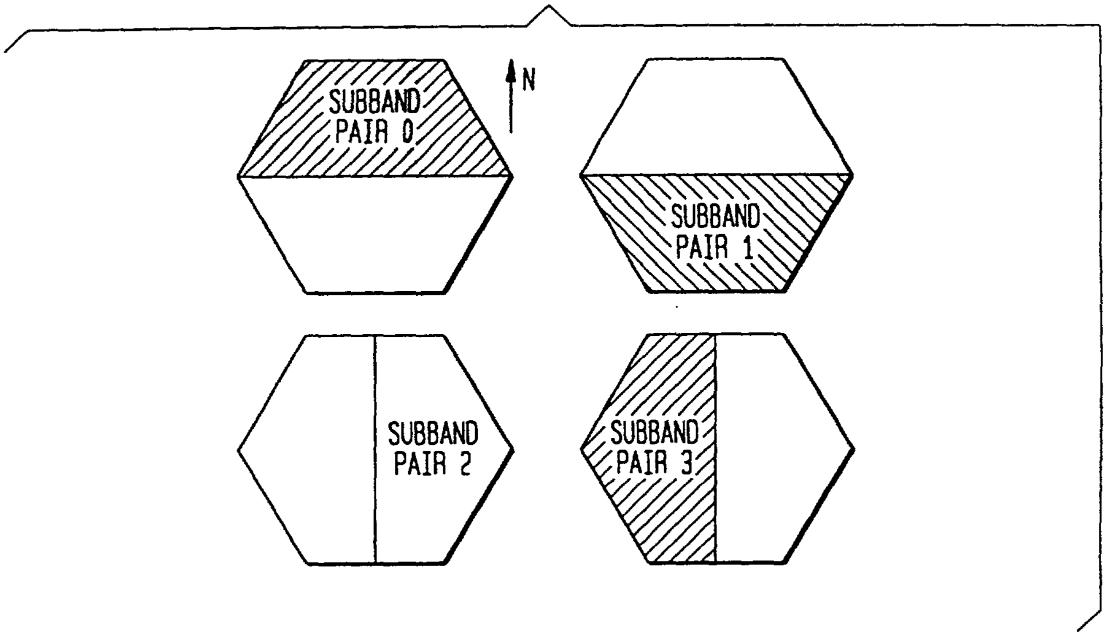
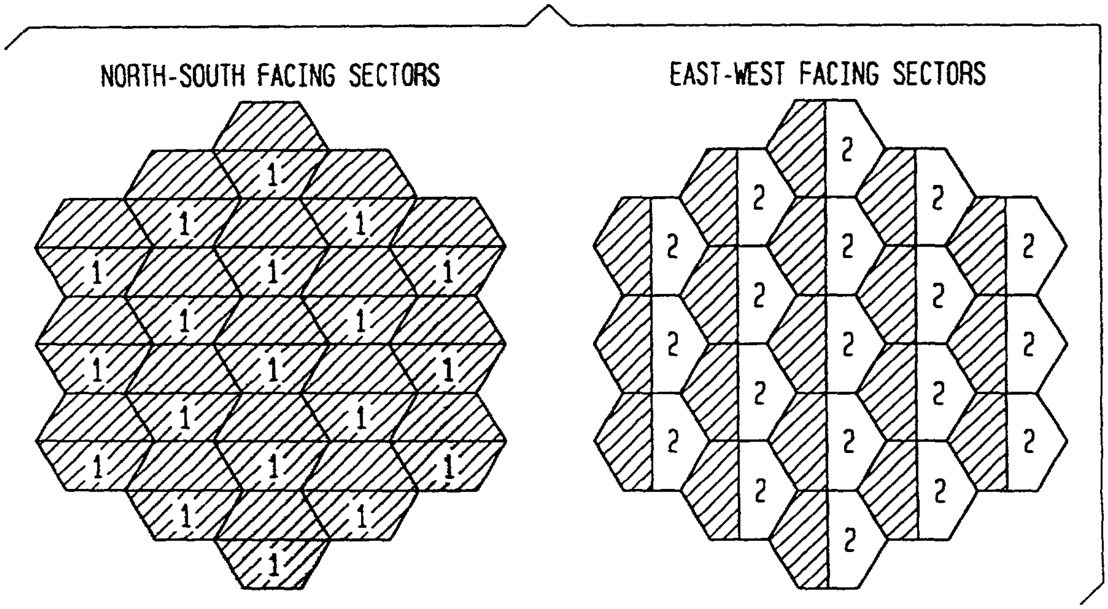

N
SUBBAND PAIR 0
SUBBAND PAIR 1
SUBBAND PAIR 2
SUBBAND PAIR 3

FIG. 30


NORTH-SOUTH FACING SECTORS
EAST-WEST FACING SECTORS
1
2

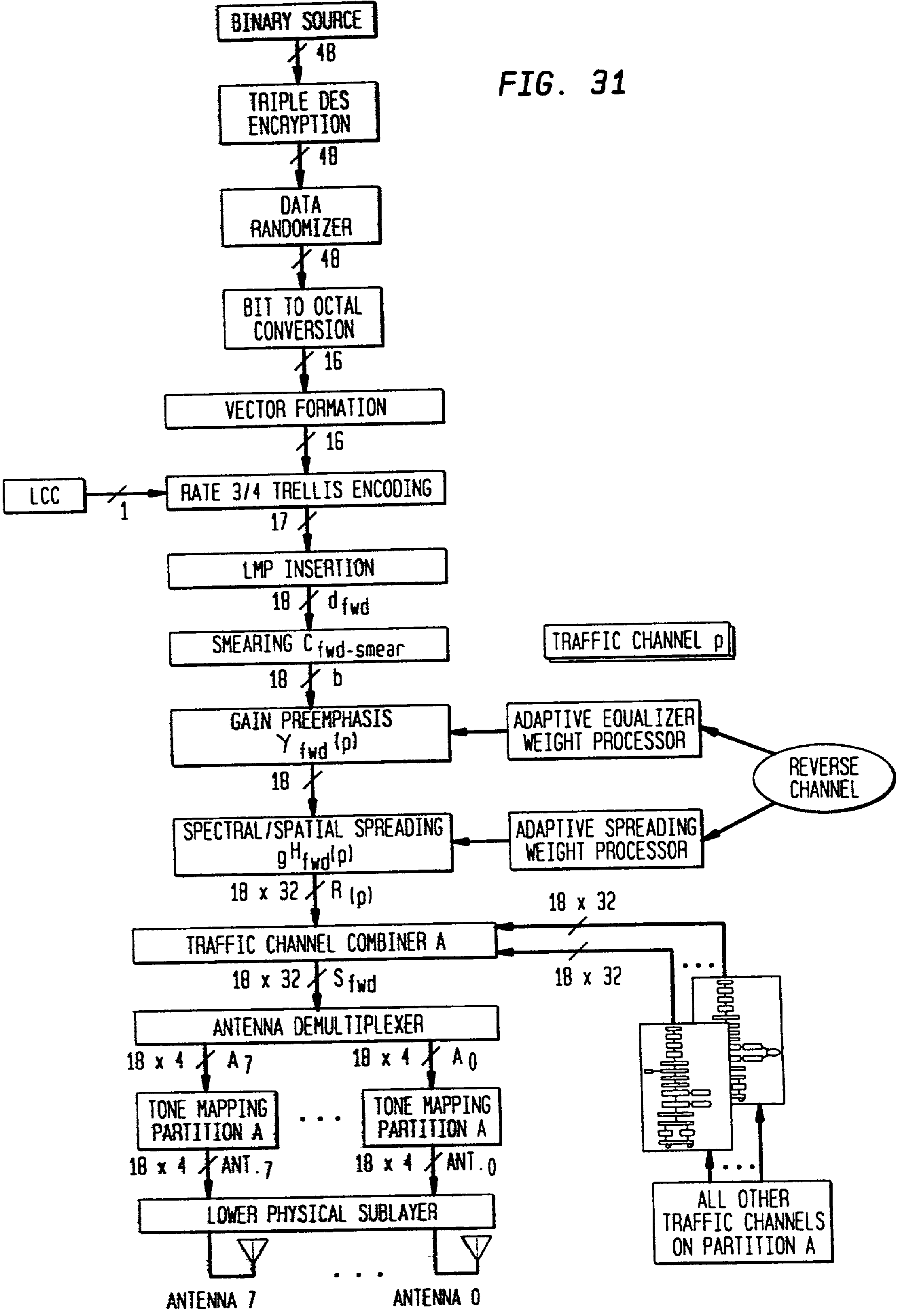

BINARY SOURCE
48
TRIPLE DES ENCRYPTION
48
DATA RANDOMIZER
48
BIT TO OCTAL CONVERSION
16
VECTOR FORMATION
16
LCC
1
RATE 3/4 TRELLIS ENCODING
17
LMP INSERTION
18
d_{fwd}
SMEARING $C_{fwd\text{-}smear}$
18
b
TRAFFIC CHANNEL p
GAIN PREEMPHASIS $\gamma_{fwd}(p)$
ADAPTIVE EQUALIZER WEIGHT PROCESSOR
REVERSE CHANNEL
18
SPECTRAL/SPATIAL SPREADING $g^{H}_{fwd}(p)$
ADAPTIVE SPREADING WEIGHT PROCESSOR
18 x 32
R (p)
18 x 32
TRAFFIC CHANNEL COMBINER A
18 x 32
18 x 32
S_{fwd}
ANTENNA DEMULTIPLEXER
18 x 4
A_7
18 x 4
A_0
TONE MAPPING PARTITION A
TONE MAPPING PARTITION A
18 x 4
$ANT._7$
18 x 4
$ANT._0$
ALL OTHER TRAFFIC CHANNELS ON PARTITION A
LOWER PHYSICAL SUBLAYER
ANTENNA 7
ANTENNA 0

FIG. 31

FIG. 32

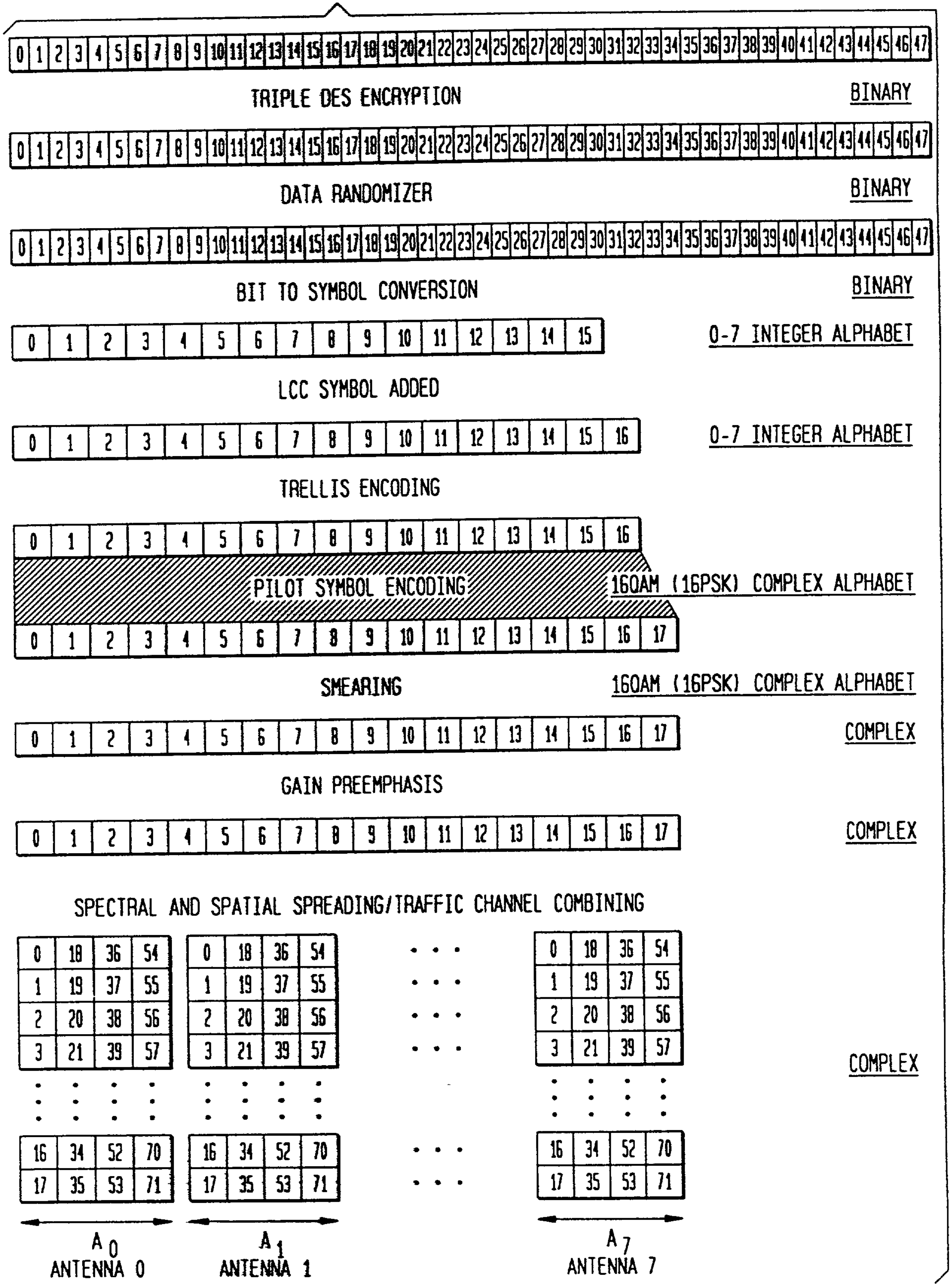

TRIPLE DES ENCRYPTION
BINARY
DATA RANDOMIZER
BINARY
BIT TO SYMBOL CONVERSION
BINARY
0-7 INTEGER ALPHABET
LCC SYMBOL ADDED
0-7 INTEGER ALPHABET
TRELLIS ENCODING
PILOT SYMBOL ENCODING
16QAM (16PSK) COMPLEX ALPHABET
SMEARING
16QAM (16PSK) COMPLEX ALPHABET
COMPLEX
GAIN PREEMPHASIS
COMPLEX
SPECTRAL AND SPATIAL SPREADING/TRAFFIC CHANNEL COMBINING
COMPLEX
A_0
ANTENNA 0
A_1
ANTENNA 1
A_7
ANTENNA 7

FIG. 33

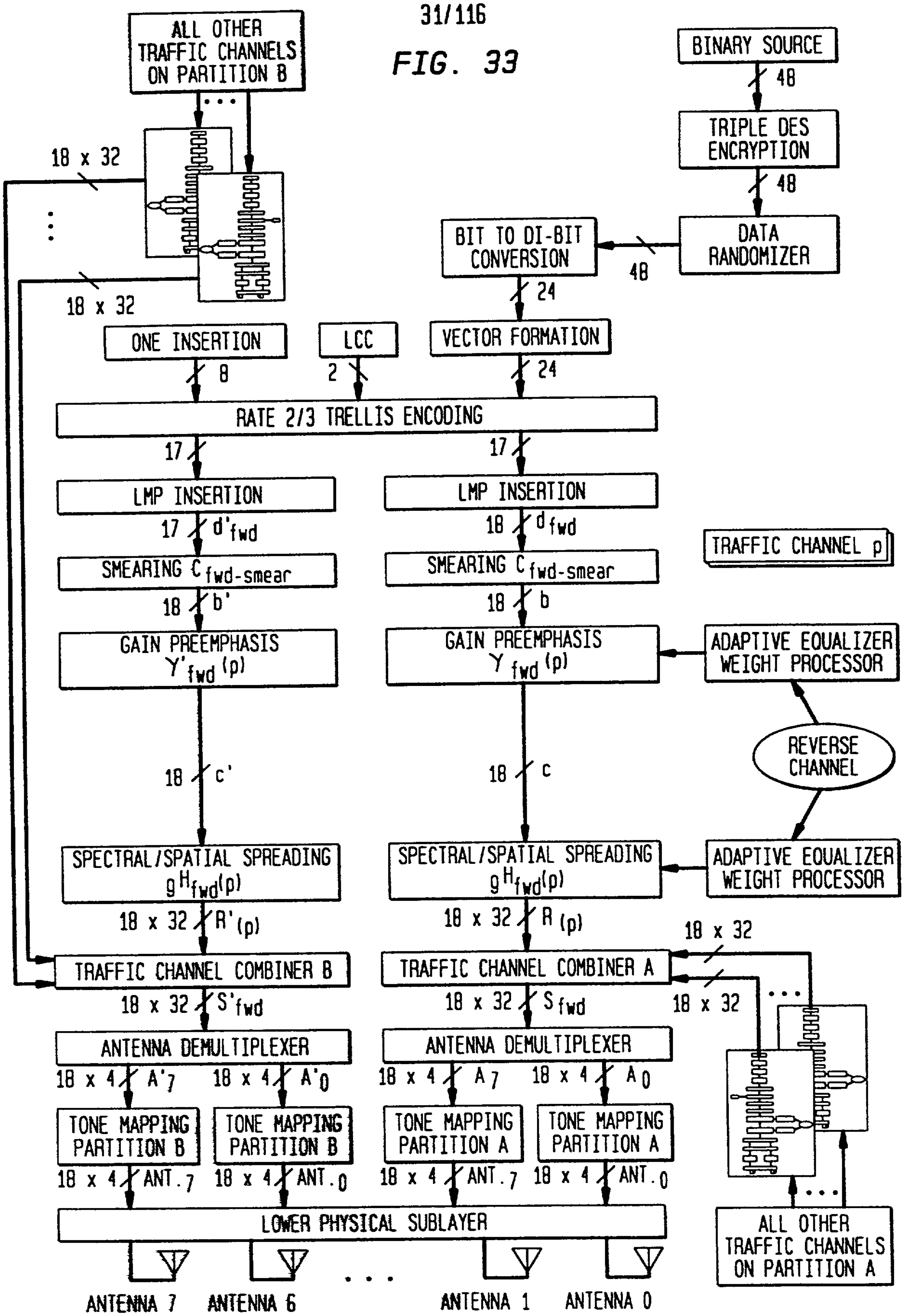
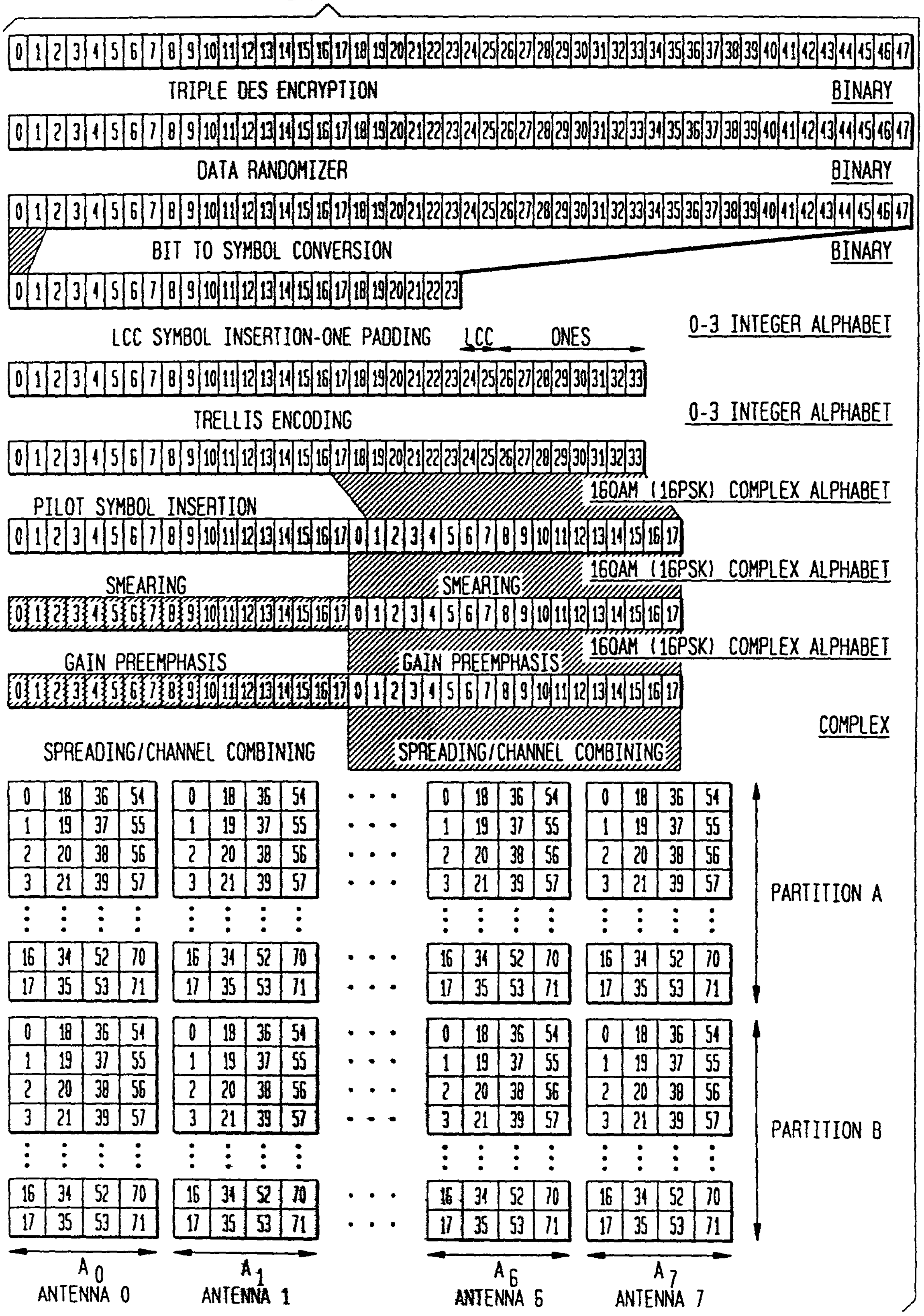

ALL OTHER TRAFFIC CHANNELS ON PARTITION B
BINARY SOURCE
48
TRIPLE DES ENCRYPTION
48
DATA RANDOMIZER
48
BIT TO DI-BIT CONVERSION
24
18 x 32
18 x 32
ONE INSERTION
8
LCC
2
VECTOR FORMATION
24
RATE 2/3 TRELLIS ENCODING
17
17
LMP INSERTION
LMP INSERTION
17 d'fwd
18 dfwd
TRAFFIC CHANNEL p
SMEARING Cfwd-smear
SMEARING Cfwd-smear
18 b'
18 b
GAIN PREEMPHASIS Y'fwd (p)
GAIN PREEMPHASIS Y fwd (p)
ADAPTIVE EQUALIZER WEIGHT PROCESSOR
REVERSE CHANNEL
18 c'
18 c
SPECTRAL/SPATIAL SPREADING gHfwd(p)
SPECTRAL/SPATIAL SPREADING gHfwd(p)
ADAPTIVE EQUALIZER WEIGHT PROCESSOR
18 x 32 R'(p)
18 x 32 R (p)
18 x 32
TRAFFIC CHANNEL COMBINER B
TRAFFIC CHANNEL COMBINER A
18 x 32 S'fwd
18 x 32 Sfwd
18 x 32
ANTENNA DEMULTIPLEXER
ANTENNA DEMULTIPLEXER
18 x 4 A'7
18 x 4 A'0
18 x 4 A7
18 x 4 A0
TONE MAPPING PARTITION B
TONE MAPPING PARTITION B
TONE MAPPING PARTITION A
TONE MAPPING PARTITION A
18 x 4 ANT.7
18 x 4 ANT.0
18 x 4 ANT.7
18 x 4 ANT.0
ALL OTHER TRAFFIC CHANNELS ON PARTITION A
LOWER PHYSICAL SUBLAYER
ANTENNA 7
ANTENNA 6
ANTENNA 1
ANTENNA 0

FIG. 34


TRIPLE DES ENCRYPTION
BINARY
DATA RANDOMIZER
BINARY
BIT TO SYMBOL CONVERSION
BINARY
LCC SYMBOL INSERTION-ONE PADDING
LCC
ONES
0-3 INTEGER ALPHABET
TRELLIS ENCODING
0-3 INTEGER ALPHABET
PILOT SYMBOL INSERTION
16QAM (16PSK) COMPLEX ALPHABET
SMEARING
SMEARING
16QAM (16PSK) COMPLEX ALPHABET
GAIN PREEMPHASIS
GAIN PREEMPHASIS
16QAM (16PSK) COMPLEX ALPHABET
COMPLEX
SPREADING/CHANNEL COMBINING
SPREADING/CHANNEL COMBINING
PARTITION A
PARTITION B
A_0
ANTENNA 0
A_1
ANTENNA 1
A_6
ANTENNA 6
A_7
ANTENNA 7

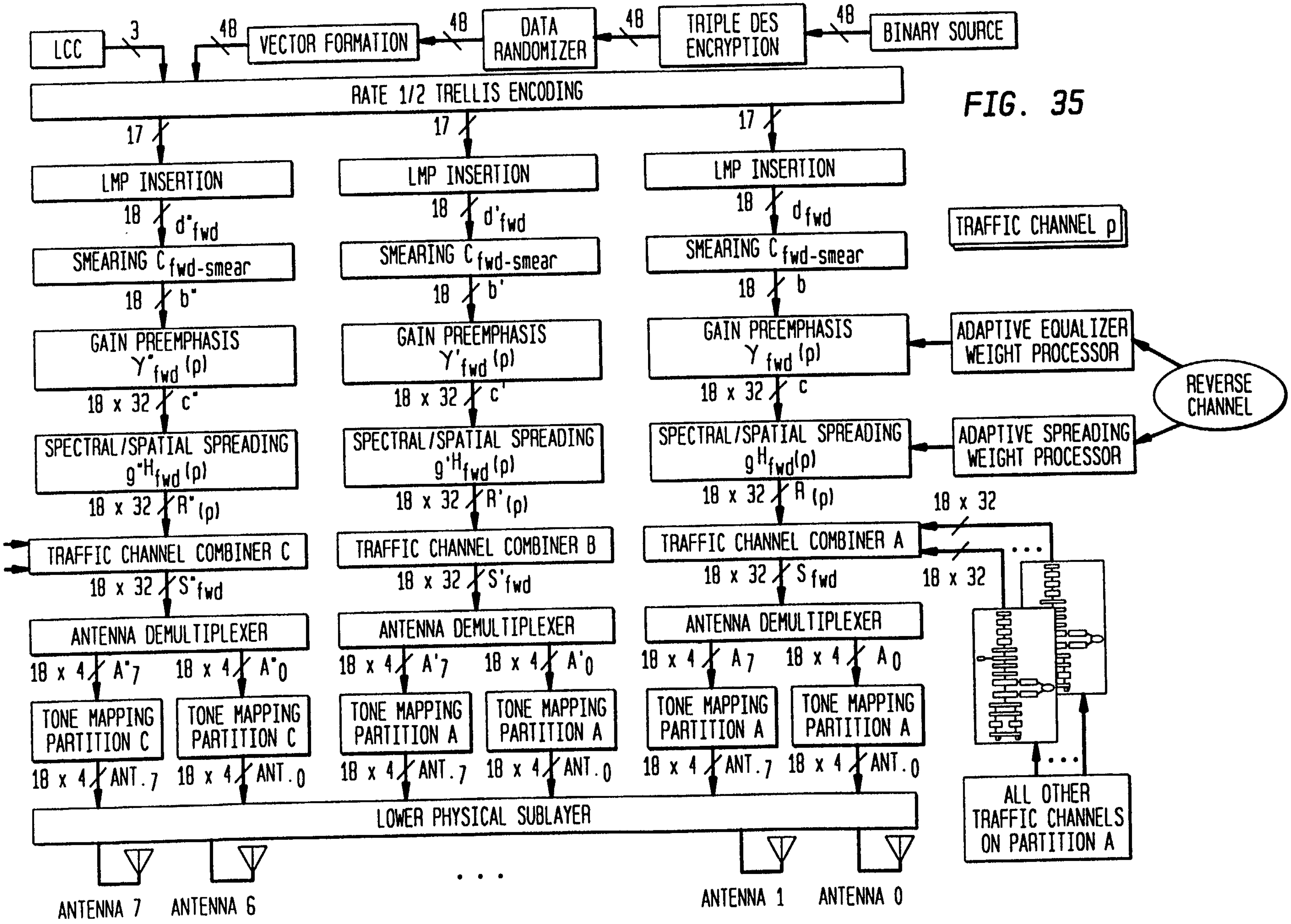
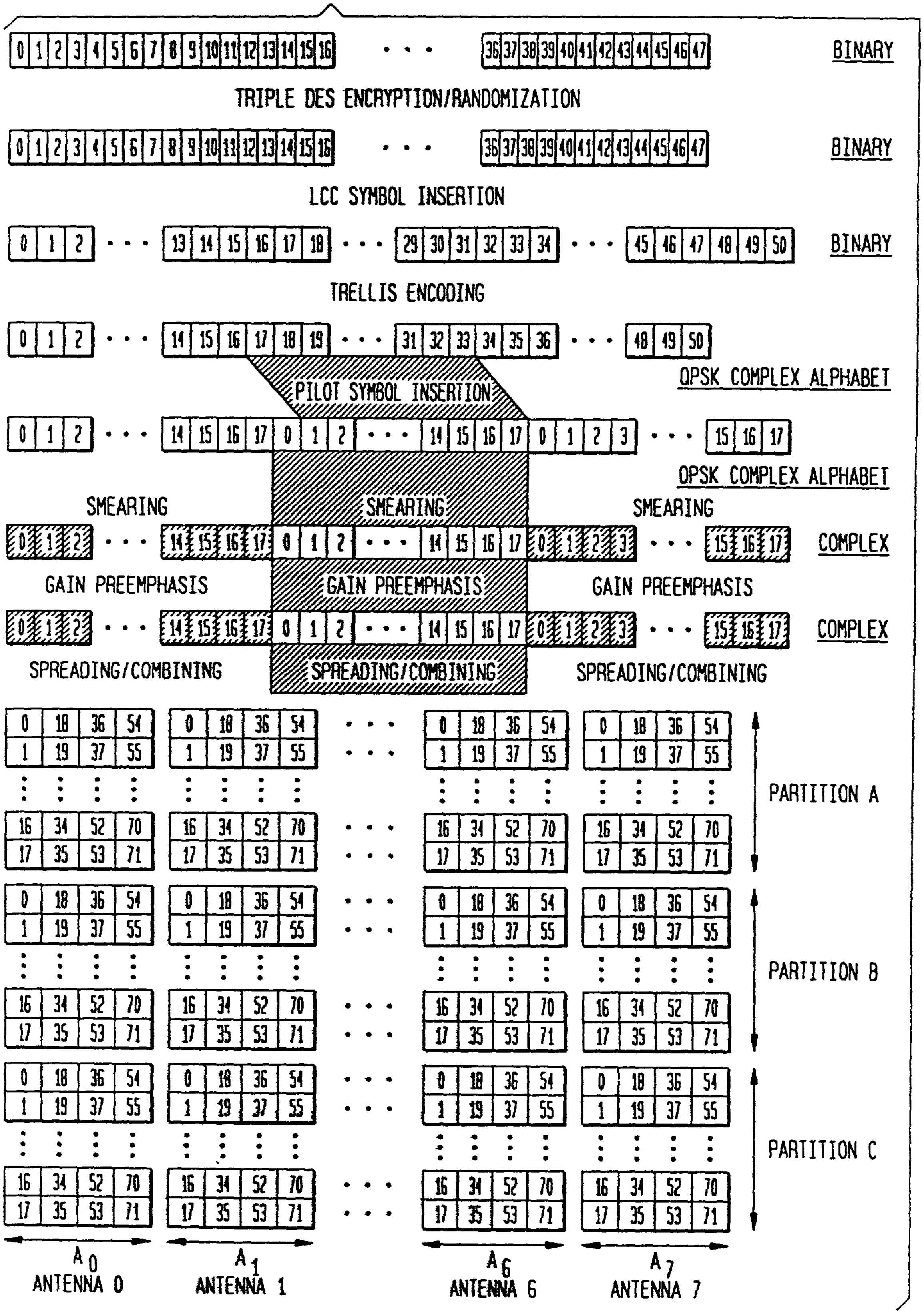


FIG. 35

LCC
3
48
VECTOR FORMATION
48
DATA RANDOMIZER
48
TRIPLE DES ENCRYPTION
48
BINARY SOURCE
RATE 1/2 TRELLIS ENCODING
17
LMP INSERTION
18
d"fwd
SMEARING C fwd-smear
18
b"
GAIN PREEMPHASIS Y"fwd (p)
18 x 32
c"
SPECTRAL/SPATIAL SPREADING g"Hfwd (p)
18 x 32
R" (p)
TRAFFIC CHANNEL COMBINER C
18 x 32
S"fwd
ANTENNA DEMULTIPLEXER
18 x 4
A"7
18 x 4
A"0
TONE MAPPING PARTITION C
TONE MAPPING PARTITION C
18 x 4
ANT.7
18 x 4
ANT.0
17
LMP INSERTION
18
d'fwd
SMEARING C fwd-smear
18
b'
GAIN PREEMPHASIS Y'fwd (p)
18 x 32
c'
SPECTRAL/SPATIAL SPREADING g'Hfwd (p)
18 x 32
R' (p)
TRAFFIC CHANNEL COMBINER B
18 x 32
S'fwd
ANTENNA DEMULTIPLEXER
18 x 4
A'7
18 x 4
A'0
TONE MAPPING PARTITION A
TONE MAPPING PARTITION A
18 x 4
ANT.7
18 x 4
ANT.0
17
LMP INSERTION
18
dfwd
SMEARING C fwd-smear
18
b
GAIN PREEMPHASIS Y fwd (p)
18 x 32
c
SPECTRAL/SPATIAL SPREADING g Hfwd(p)
18 x 32
R (p)
TRAFFIC CHANNEL COMBINER A
18 x 32
S fwd
ANTENNA DEMULTIPLEXER
18 x 4
A7
18 x 4
A0
TONE MAPPING PARTITION A
TONE MAPPING PARTITION A
18 x 4
ANT.7
18 x 4
ANT.0
TRAFFIC CHANNEL p
ADAPTIVE EQUALIZER WEIGHT PROCESSOR
REVERSE CHANNEL
ADAPTIVE SPREADING WEIGHT PROCESSOR
18 x 32
18 x 32
ALL OTHER TRAFFIC CHANNELS ON PARTITION A
LOWER PHYSICAL SUBLAYER
ANTENNA 7
ANTENNA 6
ANTENNA 1
ANTENNA 0

FIG. 36



BINARY
TRIPLE DES ENCRYPTION/RANDOMIZATION
BINARY
LCC SYMBOL INSERTION
BINARY
TRELLIS ENCODING
QPSK COMPLEX ALPHABET
PILOT SYMBOL INSERTION
QPSK COMPLEX ALPHABET
SMEARING
SMEARING
SMEARING
COMPLEX
GAIN PREEMPHASIS
GAIN PREEMPHASIS
GAIN PREEMPHASIS
COMPLEX
SPREADING/COMBINING
SPREADING/COMBINING
SPREADING/COMBINING
PARTITION A
PARTITION B
PARTITION C
A_0
ANTENNA 0
A_1
ANTENNA 1
A_6
ANTENNA 6
A_7
ANTENNA 7

FIG. 37

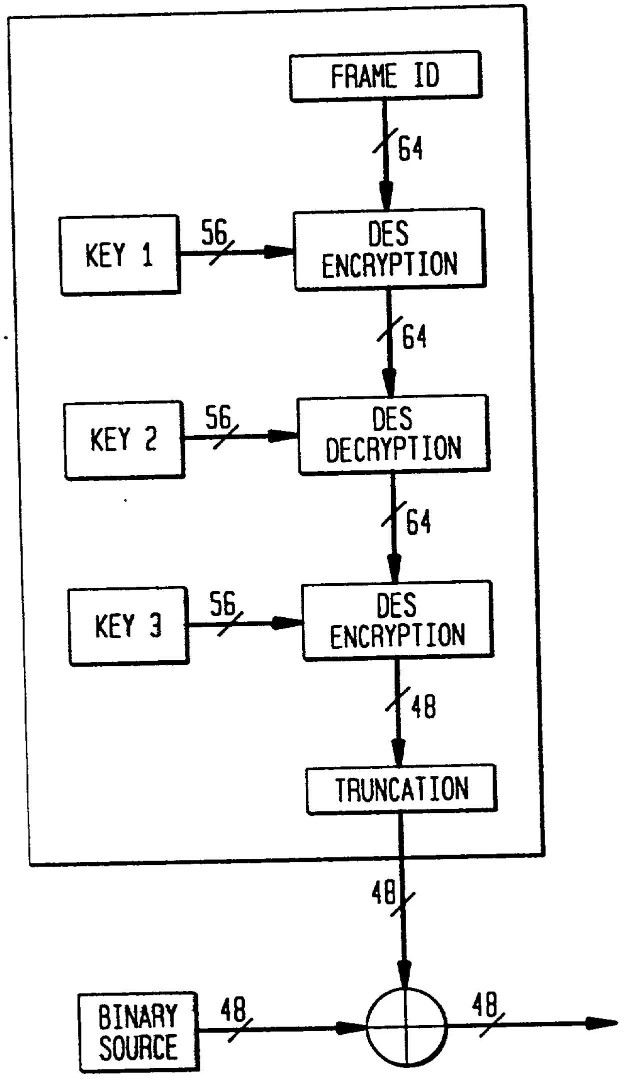
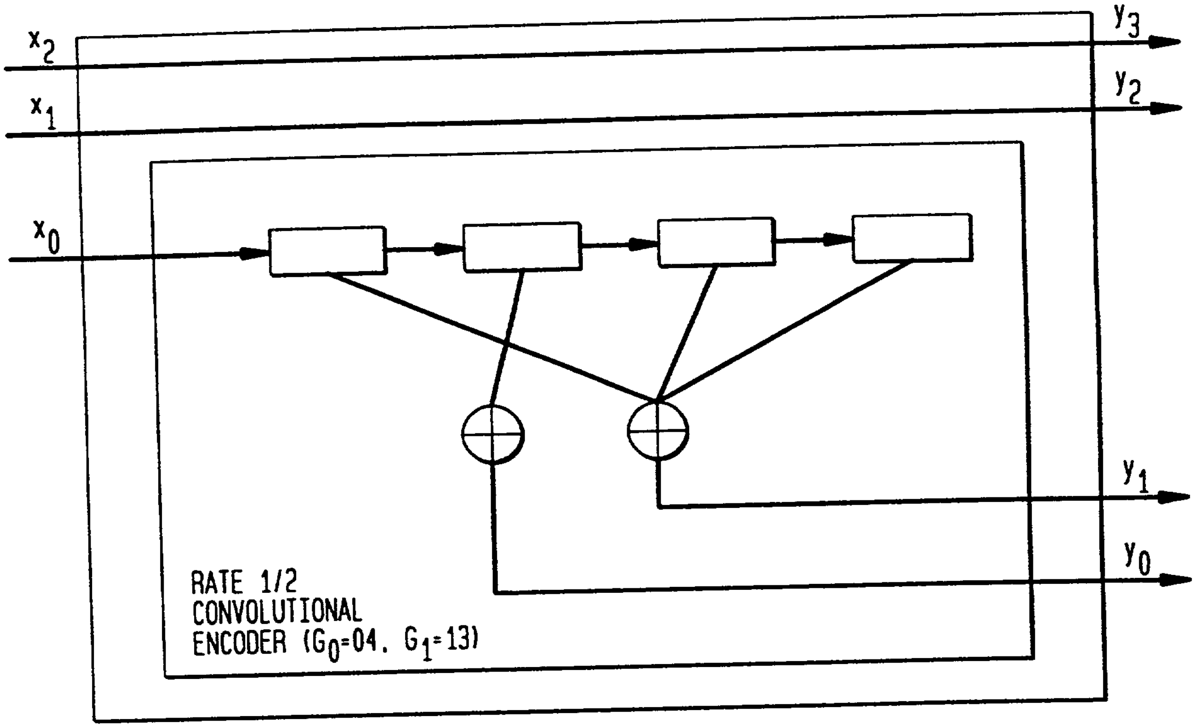
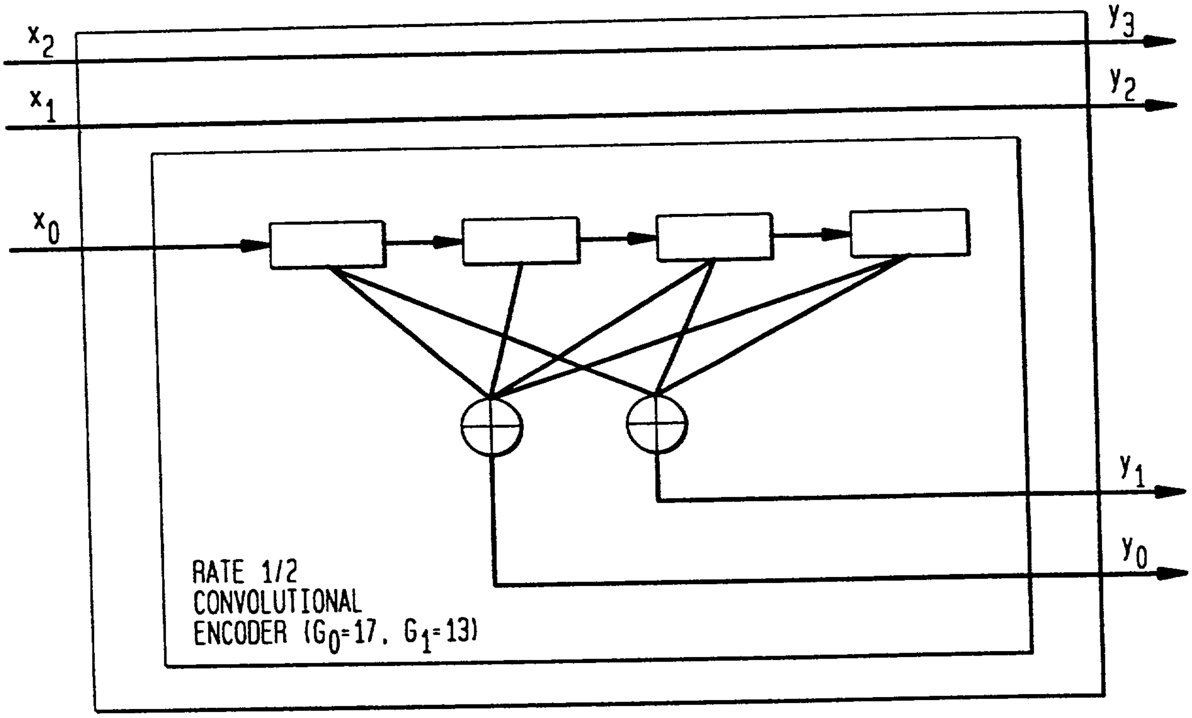

FRAME ID
64
KEY 1
56
DES ENCRYPTION
64
KEY 2
56
DES DECRYPTION
64
KEY 3
56
DES ENCRYPTION
48
TRUNCATION
48
BINARY SOURCE
48
48

FIG. 38



x_2
x_1
x_0
y_3
y_2
y_1
y_0
RATE 1/2
CONVOLUTIONAL
ENCODER (G_0=04, G_1=13)

FIG. 39



x_2
x_1
x_0
y_3
y_2
y_1
y_0
RATE 1/2
CONVOLUTIONAL
ENCODER (G_0=17, G_1=13)

FIG. 40

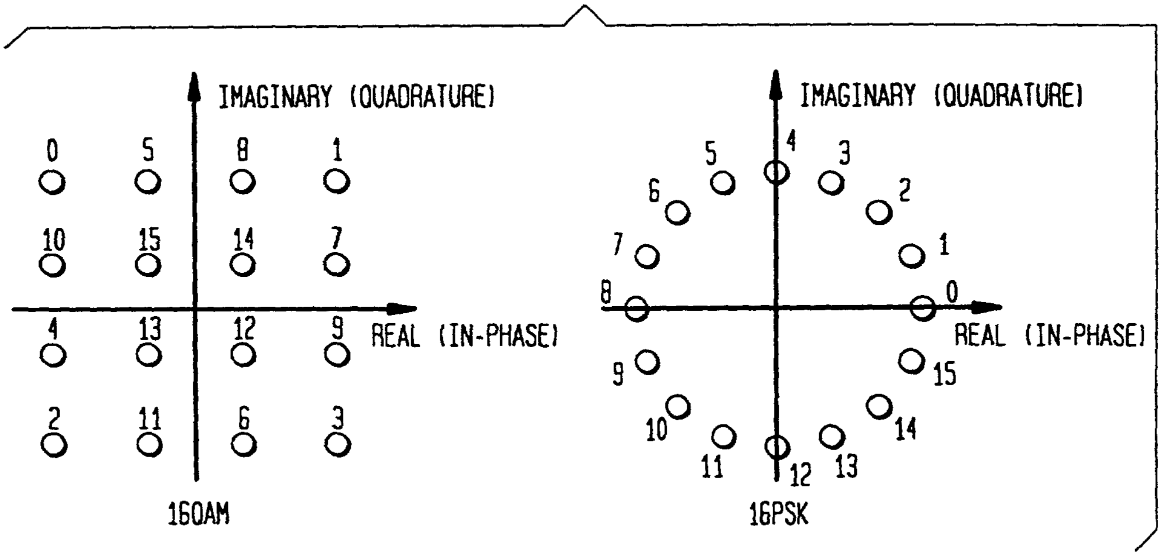

IMAGINARY (QUADRATURE)
0
5
8
1
10
15
14
7
4
13
12
9
REAL (IN-PHASE)
2
11
6
3
16QAM
IMAGINARY (QUADRATURE)
4
5
3
6
2
7
1
8
0
REAL (IN-PHASE)
9
15
10
14
11
12
13
16PSK

FIG. 41

OUTPUT SYMBOL	OUTPUT BITS				SIGNAL MAPPING (16QAM)		SIGNAL MAPPING (16PSK)	
	y_3	y_2	y_1	y_0	IN PHASE	QUADRATURE	IN PHASE	QUADRATURE
0	0	0	0	0	$-3/\sqrt{10}$	$3/\sqrt{10}$	1.0	0.0
1	0	0	0	1	$3/\sqrt{10}$	$3/\sqrt{10}$	0.924	0.383
2	0	0	1	0	$-3/\sqrt{10}$	$-3/\sqrt{10}$	0.707	0.707
3	0	0	1	1	$3/\sqrt{10}$	$-3/\sqrt{10}$	0.383	0.924
4	0	1	0	0	$-3/\sqrt{10}$	$-1/\sqrt{10}$	0	1
5	0	1	0	1	$-1/\sqrt{10}$	$3/\sqrt{10}$	-0.383	0.924
6	0	1	1	0	$1/\sqrt{10}$	$-3/\sqrt{10}$	-0.707	0.707
7	0	1	1	1	$3/\sqrt{10}$	$1/\sqrt{10}$	-0.924	0.383
8	1	0	0	0	$1/\sqrt{10}$	$3/\sqrt{10}$	-1.0	0.0
9	1	0	0	1	$3/\sqrt{10}$	$-1/\sqrt{10}$	-0.924	-0.383
10	1	0	1	0	$-3/\sqrt{10}$	$1/\sqrt{10}$	-0.707	-0.707
11	1	0	1	1	$-1/\sqrt{10}$	$-3/\sqrt{10}$	-0.383	-0.924
12	1	1	0	0	$1/\sqrt{10}$	$-1/\sqrt{10}$	0	-1
13	1	1	0	1	$-1/\sqrt{10}$	$-1/\sqrt{10}$	0.383	-0.924
14	1	1	1	0	$1/\sqrt{10}$	$1/\sqrt{10}$	0.707	-0.707
15	1	1	1	1	$-1/\sqrt{10}$	$1/\sqrt{10}$	0.924	-0.383

FIG. 42

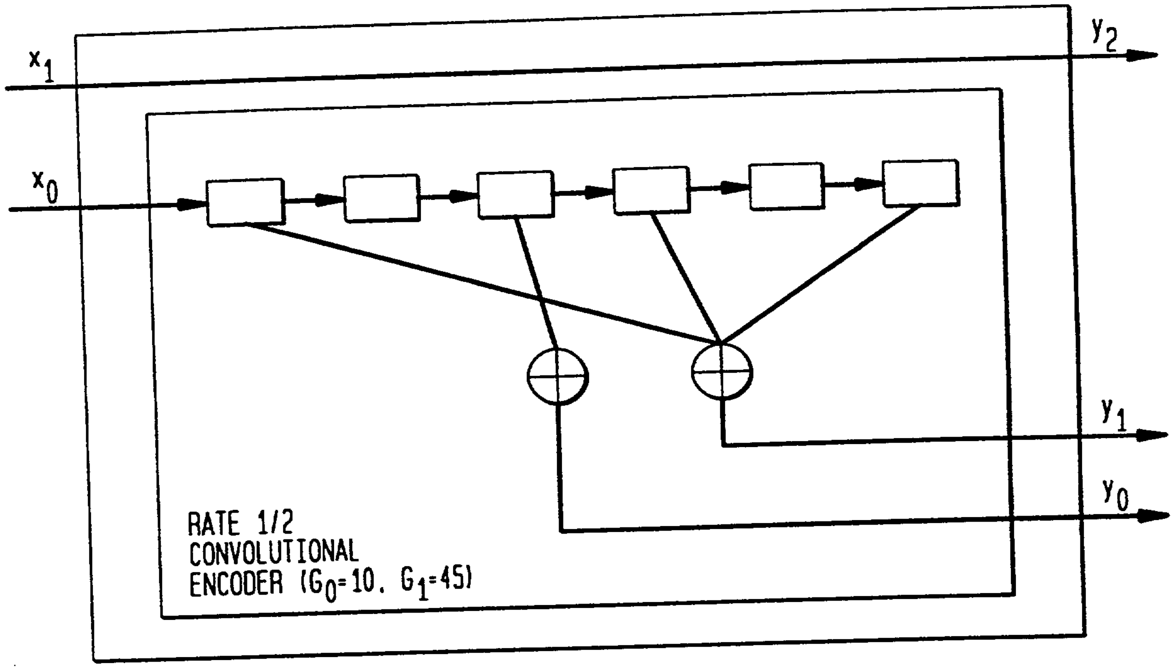

x_1
y_2
x_0
y_1
y_0
RATE 1/2
CONVOLUTIONAL
ENCODER (G_0=10, G_1=45)

FIG. 43

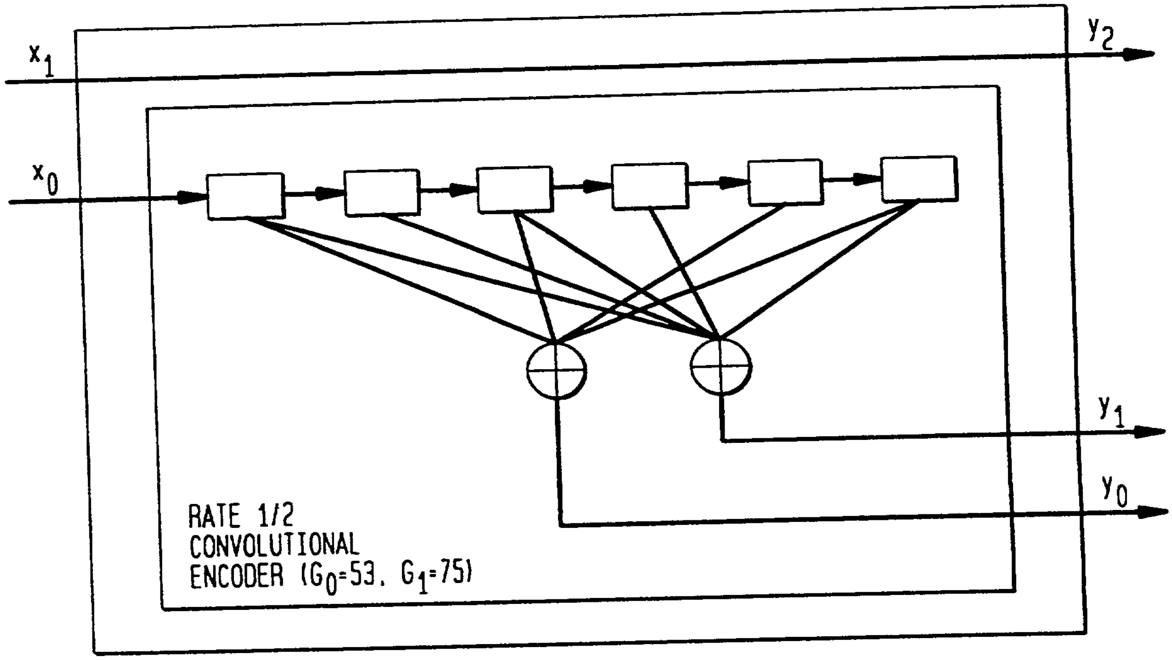

x_1
y_2
x_0
y_1
y_0
RATE 1/2
CONVOLUTIONAL
ENCODER (G_0=53, G_1=75)

FIG. 44

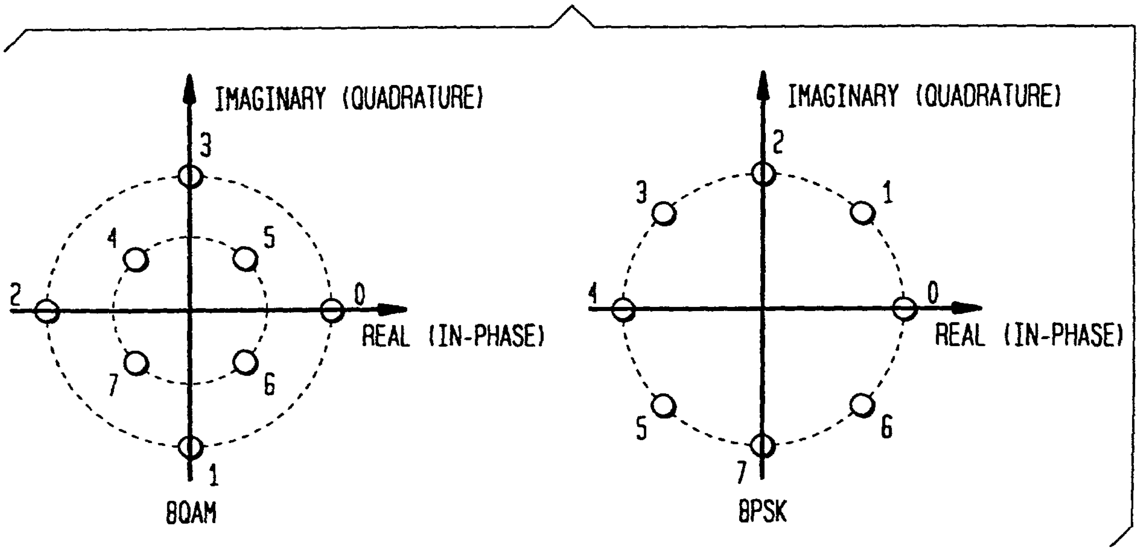


FIG. 45

OUTPUT SYMBOL	OUTPUT BITS			SIGNAL MAPPING (8QAM)		SIGNAL MAPPING (8PSK)	
	y_2	y_1	y_0	IN PHASE	QUADRATURE	IN PHASE	QUADRATURE
0	0	0	0	1.21	0	1	0
1	0	0	1	0	-1.21	$1/\sqrt{2}$	$1/\sqrt{2}$
2	0	1	0	-1.21	0	0	1
3	0	1	1	0	1.21	$-1/\sqrt{2}$	$1/\sqrt{2}$
4	1	0	0	-0.518	0.518	-1	0
5	1	0	1	0.518	0.518	$-1/\sqrt{2}$	$-1/\sqrt{2}$
6	1	1	0	-0.518	-0.518	0	-1
7	1	1	1	-0.518	-0.518	$1/\sqrt{2}$	$-1/\sqrt{2}$

FIG. 46

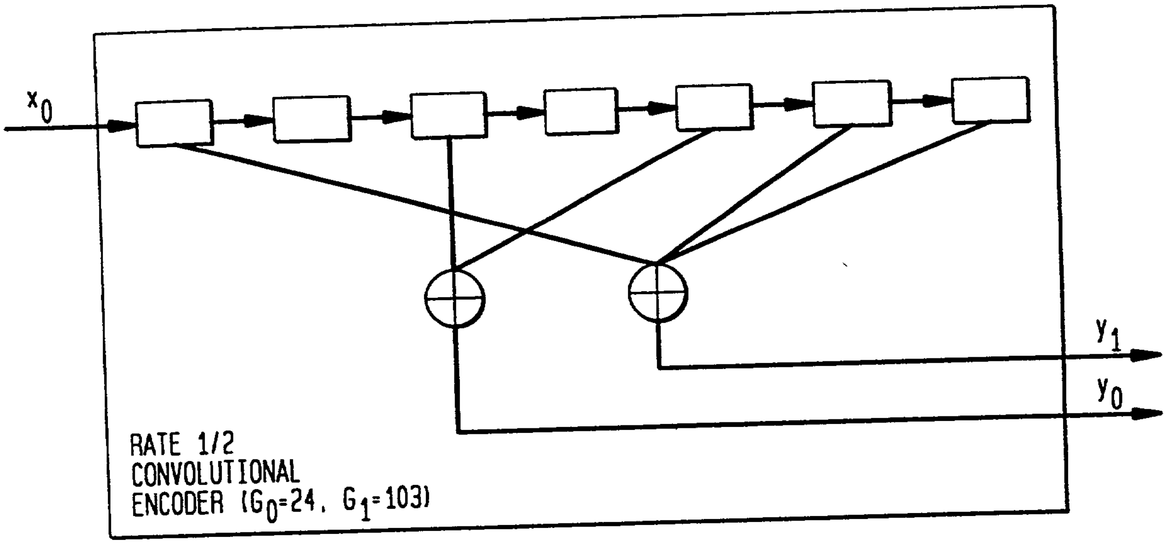

x_0
y_1
y_0
RATE 1/2
CONVOLUTIONAL
ENCODER (G_0=24, G_1=103)

FIG. 47

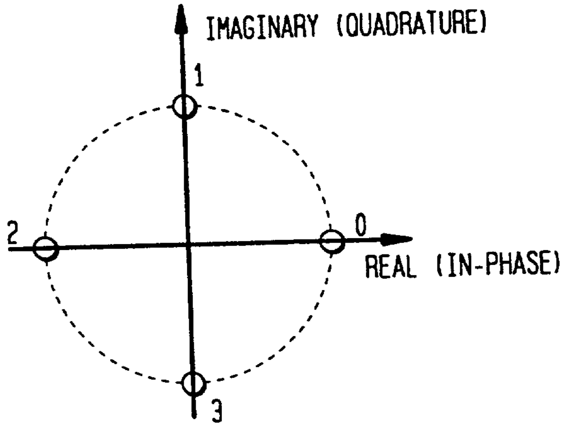

IMAGINARY (QUADRATURE)
1
2
0
REAL (IN-PHASE)
3

FIG. 48

OUTPUT SYMBOL	OUTPUT BITS		SIGNAL MAPPING	
	y_1	y_0	IN PHASE	QUADRATURE
0	0	0	1	0
1	0	1	0	1
2	1	0	-1	0
3	1	1	0	-1

FIG. 49

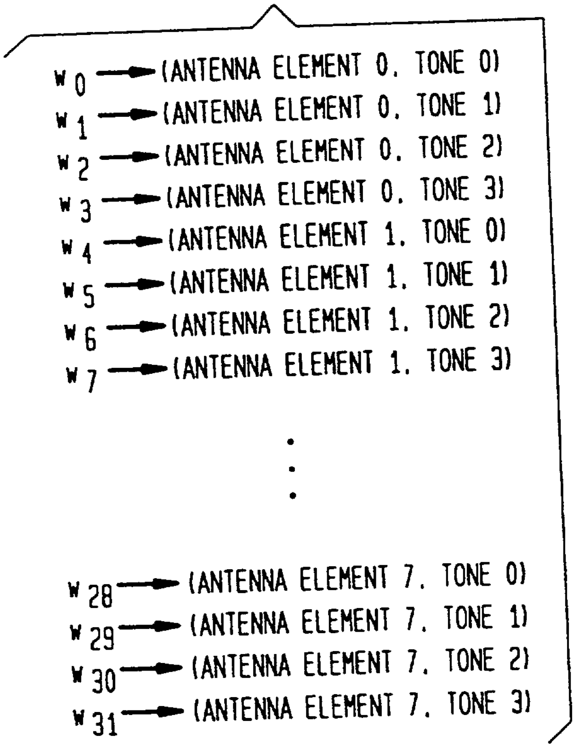


FIG. 50

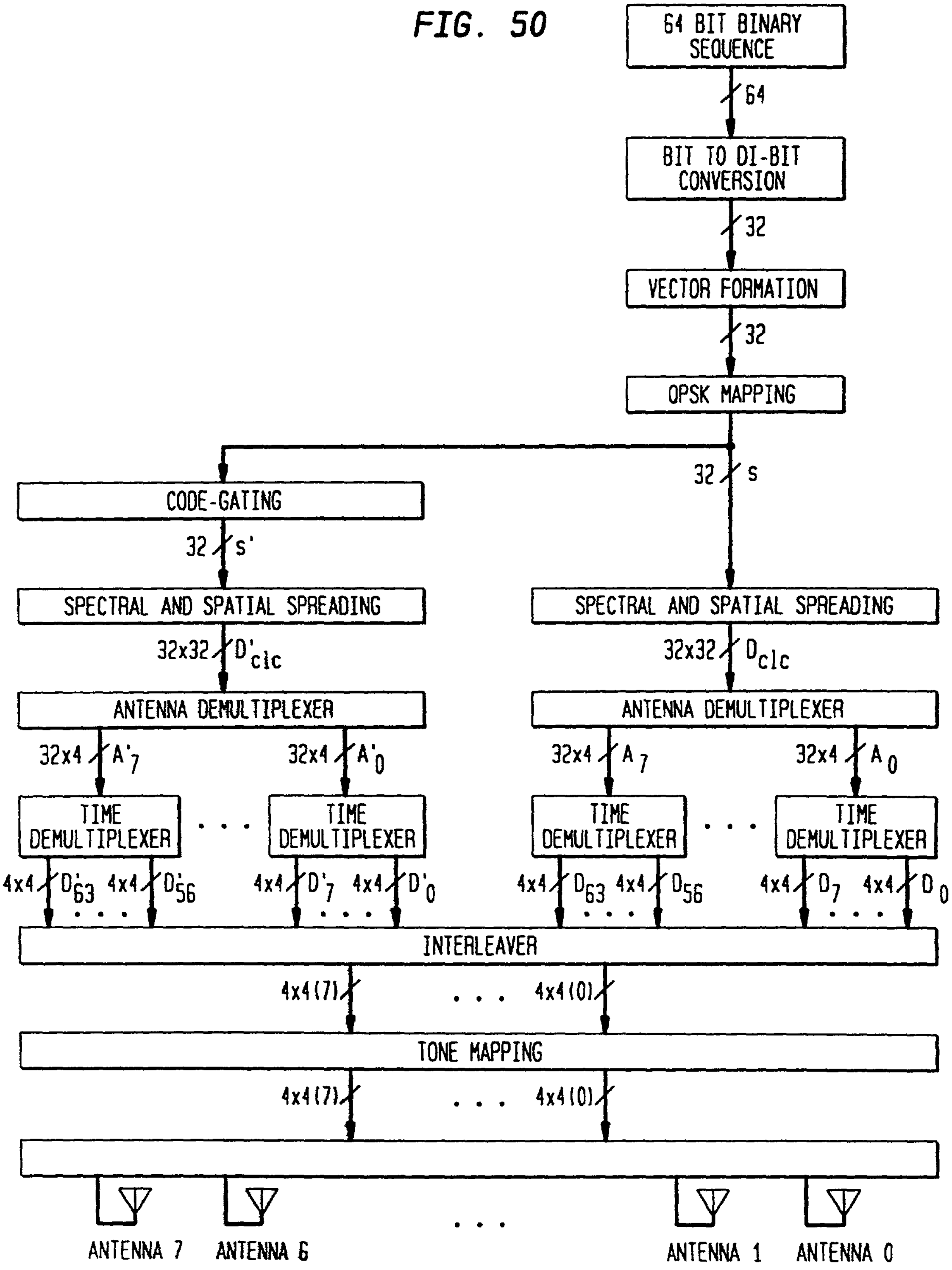

64 BIT BINARY SEQUENCE
64
BIT TO DI-BIT CONVERSION
32
VECTOR FORMATION
32
QPSK MAPPING
32 s
CODE-GATING
32 s'
SPECTRAL AND SPATIAL SPREADING
32x32 D'clc
SPECTRAL AND SPATIAL SPREADING
32x32 Dclc
ANTENNA DEMULTIPLEXER
32x4 A'7
32x4 A'0
ANTENNA DEMULTIPLEXER
32x4 A7
32x4 A0
TIME DEMULTIPLEXER
. . .
TIME DEMULTIPLEXER
TIME DEMULTIPLEXER
. . .
TIME DEMULTIPLEXER
4x4 D'63
4x4 D'56
4x4 D'7
4x4 D'0
4x4 D63
4x4 D56
4x4 D7
4x4 D0
INTERLEAVER
4x4(7)
. . .
4x4(0)
TONE MAPPING
4x4(7)
. . .
4x4(0)
ANTENNA 7
ANTENNA 6
. . .
ANTENNA 1
ANTENNA 0

FIG. 51

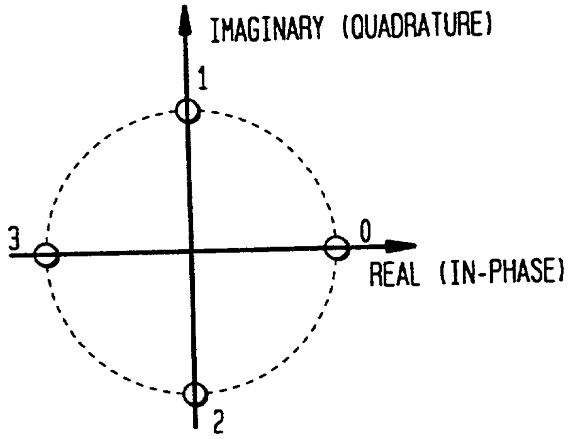


FIG. 51'

SYMBOL	SIGNAL MAPPING (16QAM)	
	IN PHASE	QUADRATURE
0	1	0
1	0	1
2	0	-1
3	-1	0

FIG. 52

	BURST NUMBER															
ANTENNA	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	D_0	D_1	D_2	D_3	D_4	D_5	D_6	D_7	D'_7	D'_6	D'_5	D'_4	D'_3	D'_2	D'_1	D'_0
1	D_8	D_9	D_{10}	D_{11}	D_{12}	D_{13}	D_{14}	D_{15}	D'_{15}	D'_{14}	D'_{13}	D'_{12}	D'_{11}	D'_{10}	D'_9	D'_8
2	D_{16}	D_{17}	D_{18}	D_{19}	D_{20}	D_{21}	D_{22}	D_{23}	D'_{23}	D'_{22}	D'_{21}	D'_{20}	D'_{19}	D'_{18}	D'_{17}	D'_{16}
3	D_{24}	D_{25}	D_{26}	D_{27}	D_{28}	D_{29}	D_{30}	D_{31}	D'_{31}	D'_{30}	D'_{29}	D'_{28}	D'_{27}	D'_{26}	D'_{25}	D'_{24}
4	D_{32}	D_{33}	D_{34}	D_{35}	D_{36}	D_{37}	D_{38}	D_{39}	D'_{39}	D'_{38}	D'_{37}	D'_{36}	D'_{35}	D'_{34}	D'_{33}	D'_{32}
5	D_{40}	D_{41}	D_{42}	D_{43}	D_{44}	D_{45}	D_{46}	D_{47}	D'_{47}	D'_{46}	D'_{45}	D'_{44}	D'_{43}	D'_{42}	D'_{41}	D'_{40}
6	D_{48}	D_{49}	D_{50}	D_{51}	D_{52}	D_{53}	D_{54}	D_{55}	D'_{55}	D'_{54}	D'_{53}	D'_{52}	D'_{51}	D'_{50}	D'_{49}	D'_{48}
7	D_{56}	D_{57}	D_{58}	D_{59}	D_{60}	D_{61}	D_{62}	D_{63}	D'_{63}	D'_{62}	D'_{61}	D'_{60}	D'_{59}	D'_{58}	D'_{57}	D'_{56}

FIG. 53

		COLUMN NUMBER			
		0	1	2	3
ROW NUMBER	0	$CLC_i(0)$[a]	$CLC_i(4)$	$CLC_i(8)$	$CLC_i(12)$
	1	$CLC_i(1)$	$CLC_i(5)$	$CLC_i(9)$	$CLC_i(13)$
	2	$CLC_i(2)$	$CLC_i(6)$	$CLC_i(10)$	$CLC_i(14)$
	3	$CLC_i(3)$	$CLC_i(7)$	$CLC_i(11)$	$CLC_i(15)$

a. i IS THE SUBBAND PAIR INDEX (0,1,2, OR 3)

FIG. 54

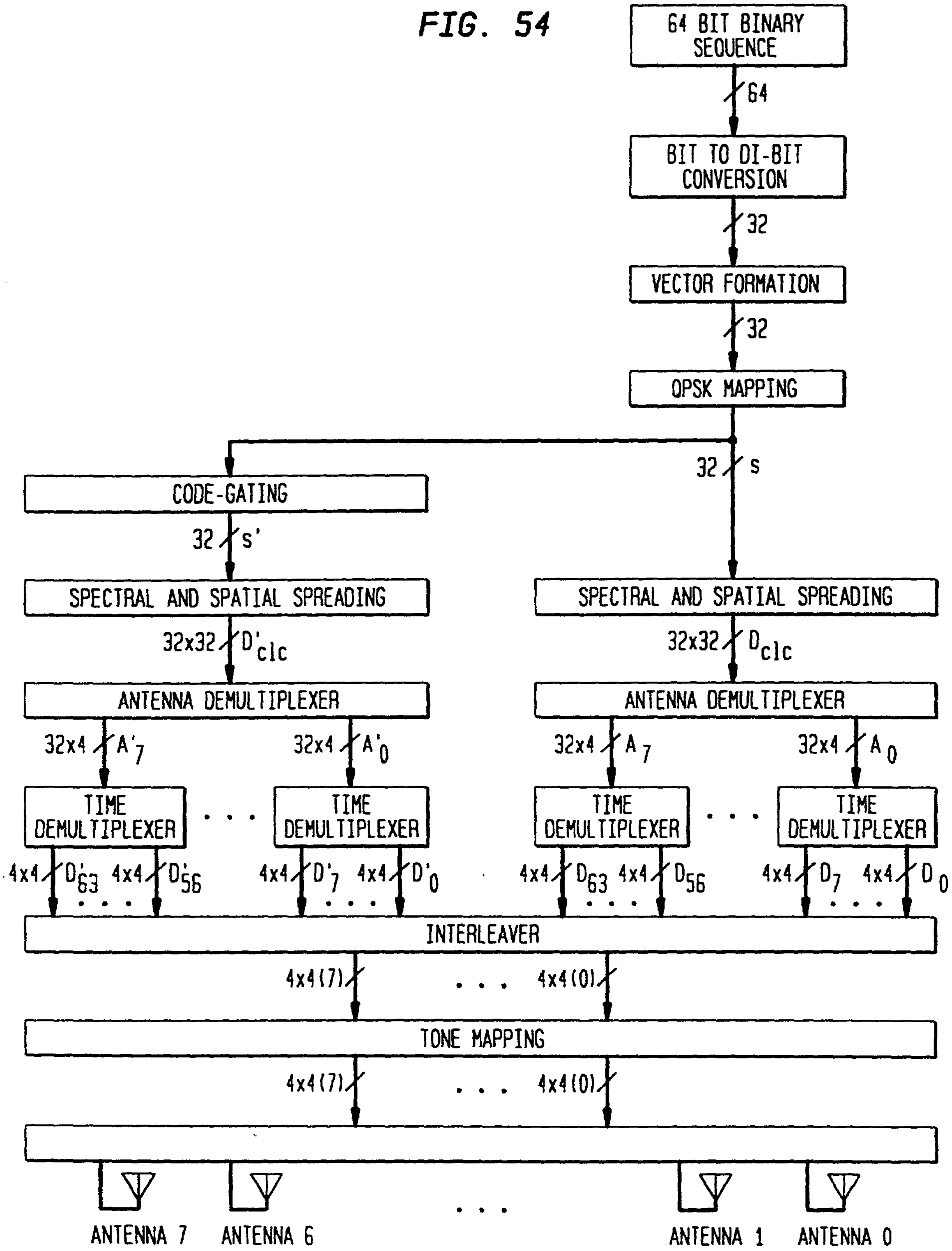
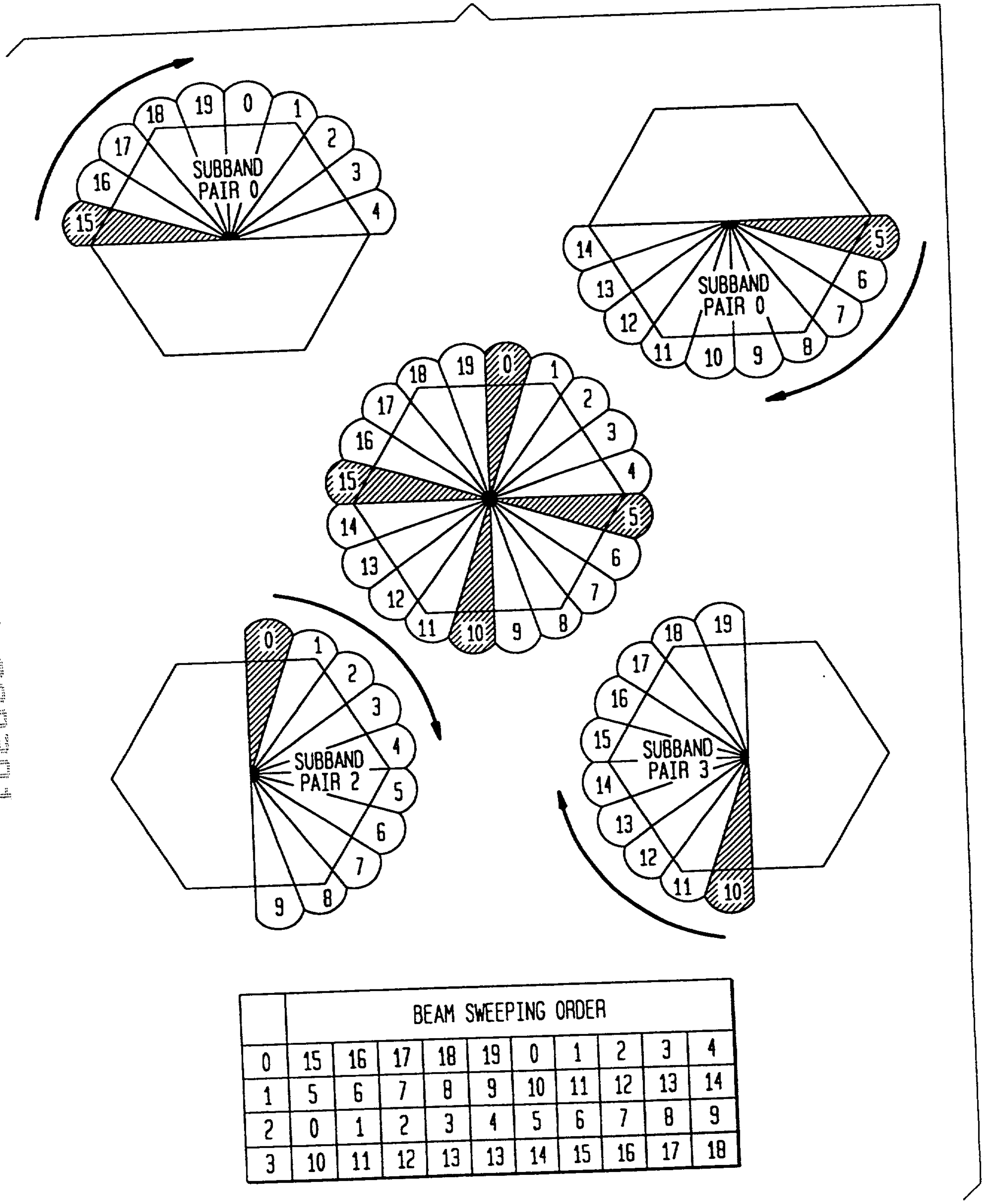

64 BIT BINARY SEQUENCE
64
BIT TO DI-BIT CONVERSION
32
VECTOR FORMATION
32
QPSK MAPPING
32 s
CODE-GATING
32 s'
SPECTRAL AND SPATIAL SPREADING
32x32 D'clc
SPECTRAL AND SPATIAL SPREADING
32x32 Dclc
ANTENNA DEMULTIPLEXER
32x4 A'7
32x4 A'0
ANTENNA DEMULTIPLEXER
32x4 A7
32x4 A0
TIME DEMULTIPLEXER
TIME DEMULTIPLEXER
TIME DEMULTIPLEXER
TIME DEMULTIPLEXER
4x4 D'63
4x4 D'56
4x4 D'7
4x4 D'0
4x4 D63
4x4 D56
4x4 D7
4x4 D0
INTERLEAVER
4x4(7)
4x4(0)
TONE MAPPING
4x4(7)
4x4(0)
ANTENNA 7
ANTENNA 6
ANTENNA 1
ANTENNA 0

FIG. 55

		COLUMN NUMBER			
		0	1	2	3
ROW NUMBER	0	$BRC_i(0)$[a]	$BRC_i(4)$	$BRC_i(8)$	$BRC_i(12)$
	1	$BRC_i(1)$	$BRC_i(5)$	$BRC_i(9)$	$BRC_i(13)$
	2	$BRC_i(2)$	$BRC_i(6)$	$BRC_i(10)$	$BRC_i(14)$
	3	$BRC_i(3)$	$BRC_i(7)$	$BRC_i(11)$	$BRC_i(15)$

[a] i IS THE SUBBAND PAIR INDEX (0,1,2, OR 3). FOR THE BROADCAST CHANNEL ALL THE SUBBAND PAIRS WILL BE ACTIVE AT THE SAME TIME.

FIG. 56



	BEAM SWEEPING ORDER									
0	15	16	17	18	19	0	1	2	3	4
1	5	6	7	8	9	10	11	12	13	14
2	0	1	2	3	4	5	6	7	8	9
3	10	11	12	13	13	14	15	16	17	18

FIG. 57

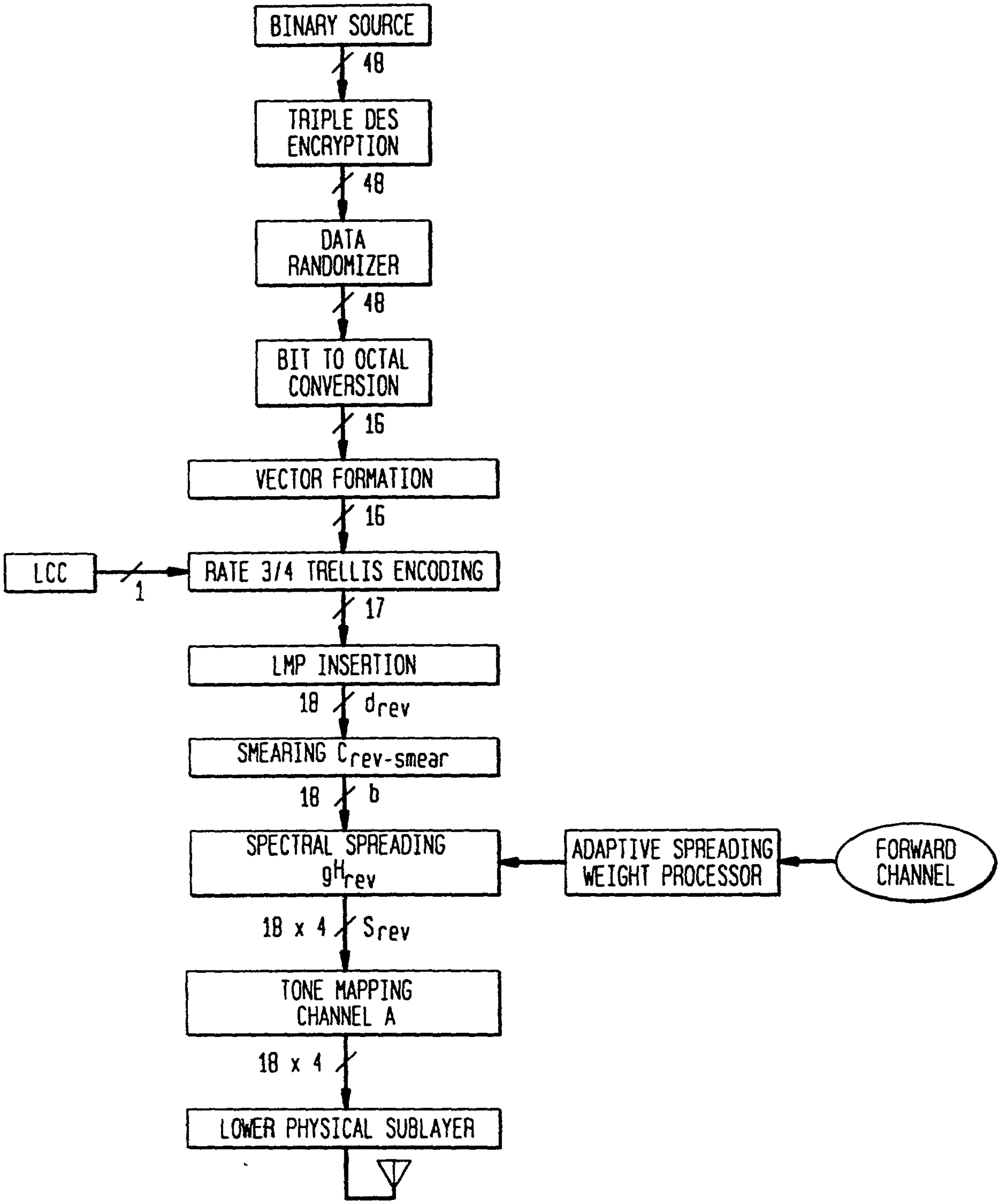

BINARY SOURCE
48
TRIPLE DES ENCRYPTION
48
DATA RANDOMIZER
48
BIT TO OCTAL CONVERSION
16
VECTOR FORMATION
16
LCC
1
RATE 3/4 TRELLIS ENCODING
17
LMP INSERTION
18
d_{rev}
SMEARING $C_{rev\text{-}smear}$
18
b
SPECTRAL SPREADING g^H_{rev}
ADAPTIVE SPREADING WEIGHT PROCESSOR
FORWARD CHANNEL
18 x 4
S_{rev}
TONE MAPPING CHANNEL A
18 x 4
LOWER PHYSICAL SUBLAYER

FIG. 58

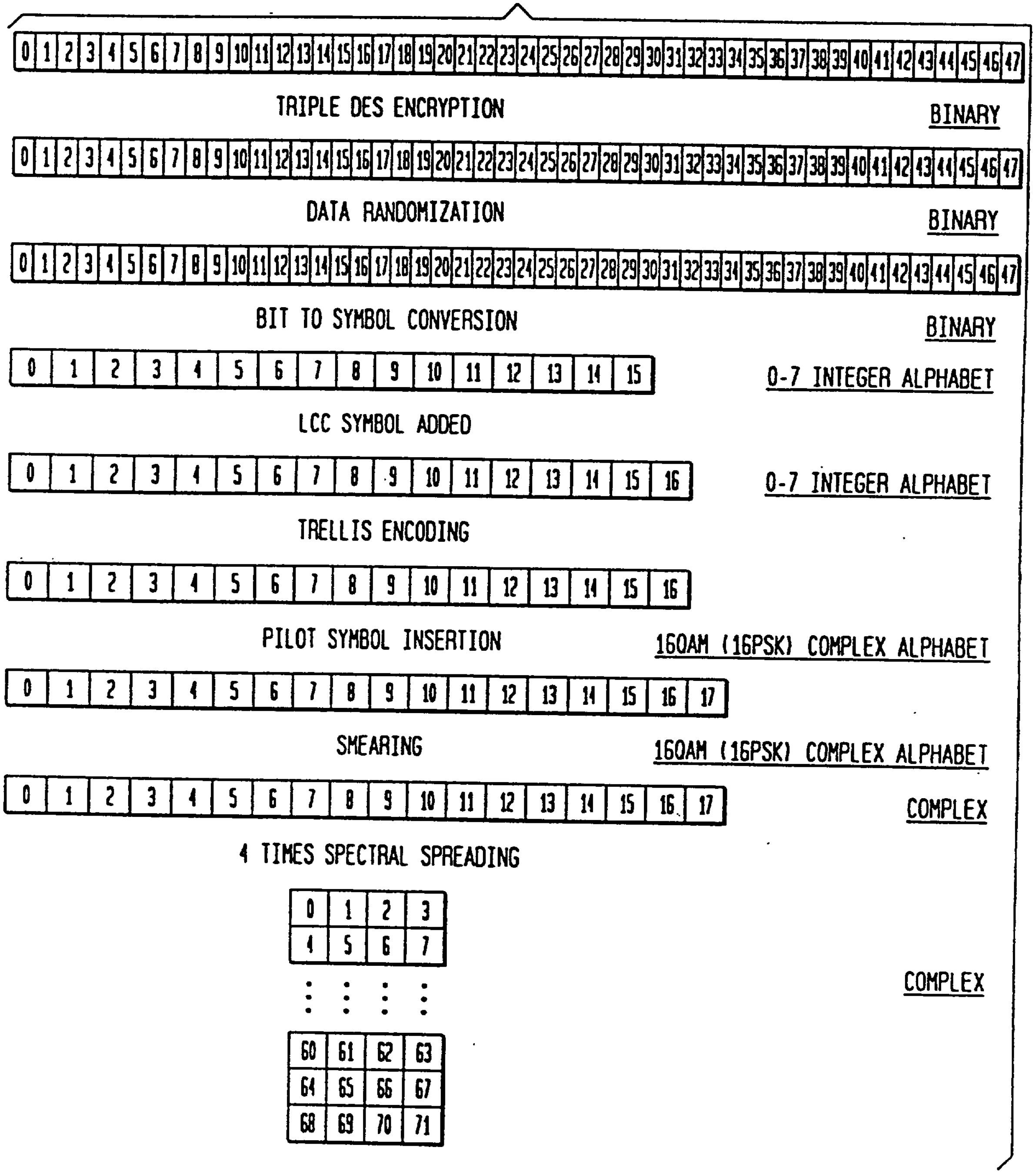

TRIPLE DES ENCRYPTION
BINARY
DATA RANDOMIZATION
BINARY
BIT TO SYMBOL CONVERSION
BINARY
LCC SYMBOL ADDED
0-7 INTEGER ALPHABET
TRELLIS ENCODING
0-7 INTEGER ALPHABET
PILOT SYMBOL INSERTION
16QAM (16PSK) COMPLEX ALPHABET
SMEARING
16QAM (16PSK) COMPLEX ALPHABET
4 TIMES SPECTRAL SPREADING
COMPLEX
COMPLEX
0 1 2 3 … 47
0 1 2 3 … 15
0 1 2 3 … 16
0 1 2 3 … 17
0 1 2 3
4 5 6 7
60 61 62 63
64 65 66 67
68 69 70 71

FIG. 59

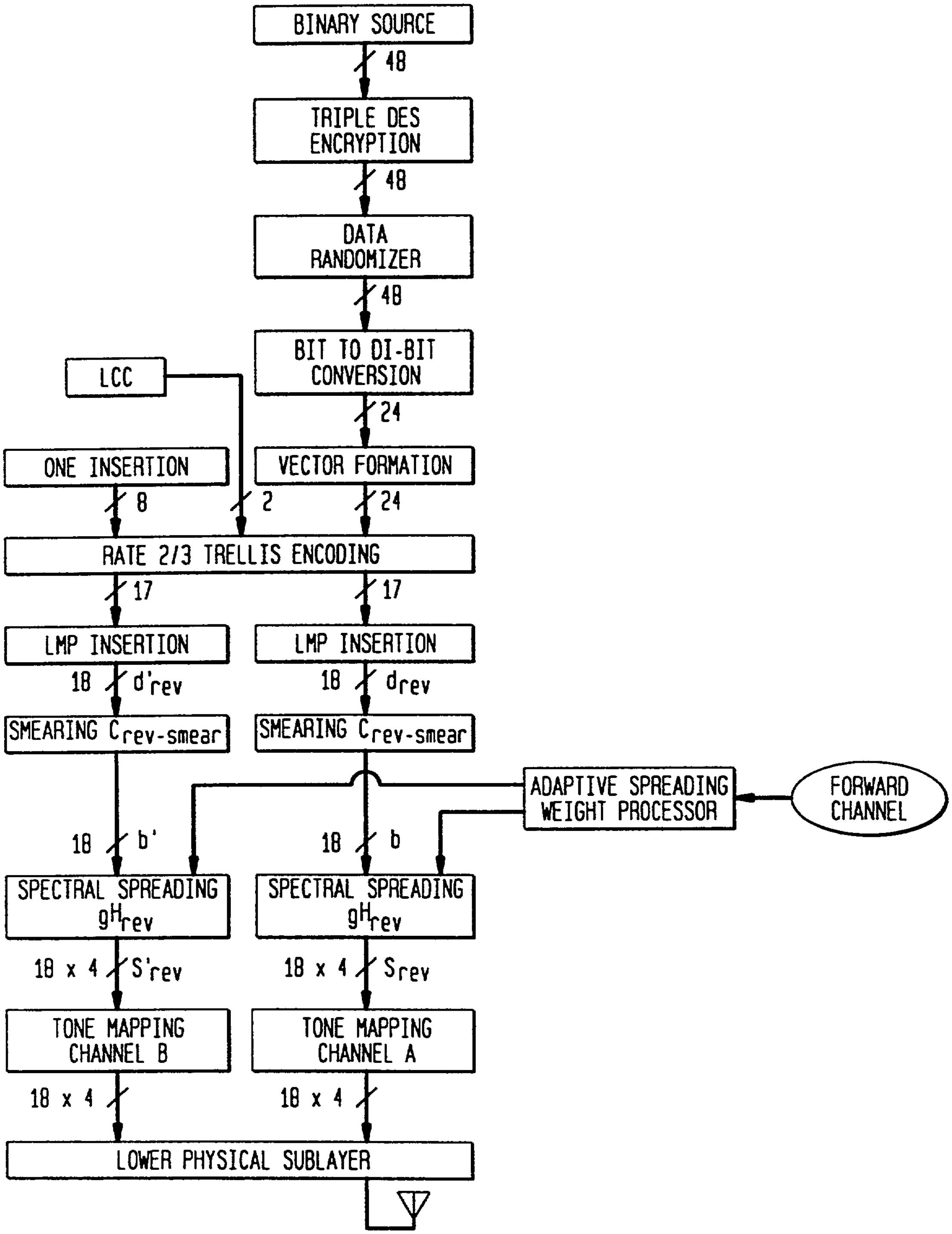

BINARY SOURCE
48
TRIPLE DES ENCRYPTION
48
DATA RANDOMIZER
48
BIT TO DI-BIT CONVERSION
24
LCC
ONE INSERTION
VECTOR FORMATION
8
2
24
RATE 2/3 TRELLIS ENCODING
17
17
LMP INSERTION
LMP INSERTION
18
d'rev
18
drev
SMEARING Crev-smear
SMEARING Crev-smear
ADAPTIVE SPREADING WEIGHT PROCESSOR
FORWARD CHANNEL
18
b'
18
b
SPECTRAL SPREADING gHrev
SPECTRAL SPREADING gHrev
18 x 4
S'rev
18 x 4
Srev
TONE MAPPING CHANNEL B
TONE MAPPING CHANNEL A
18 x 4
18 x 4
LOWER PHYSICAL SUBLAYER

FIG. 60

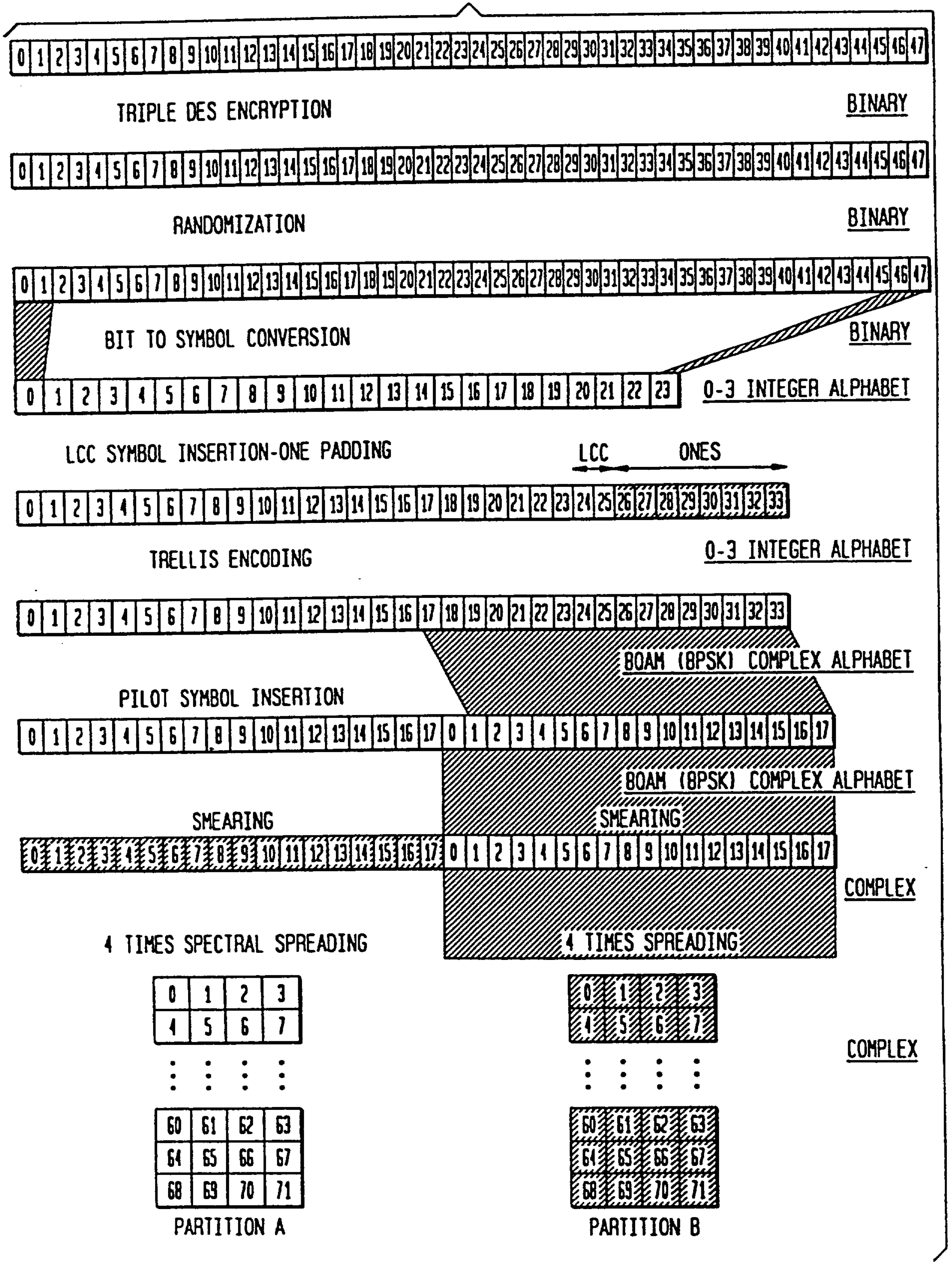

TRIPLE DES ENCRYPTION
BINARY
RANDOMIZATION
BINARY
BIT TO SYMBOL CONVERSION
BINARY
0-3 INTEGER ALPHABET
LCC SYMBOL INSERTION-ONE PADDING
LCC
ONES
TRELLIS ENCODING
0-3 INTEGER ALPHABET
8QAM (8PSK) COMPLEX ALPHABET
PILOT SYMBOL INSERTION
8QAM (8PSK) COMPLEX ALPHABET
SMEARING
SMEARING
COMPLEX
4 TIMES SPECTRAL SPREADING
4 TIMES SPREADING
COMPLEX
PARTITION A
PARTITION B

FIG. 61

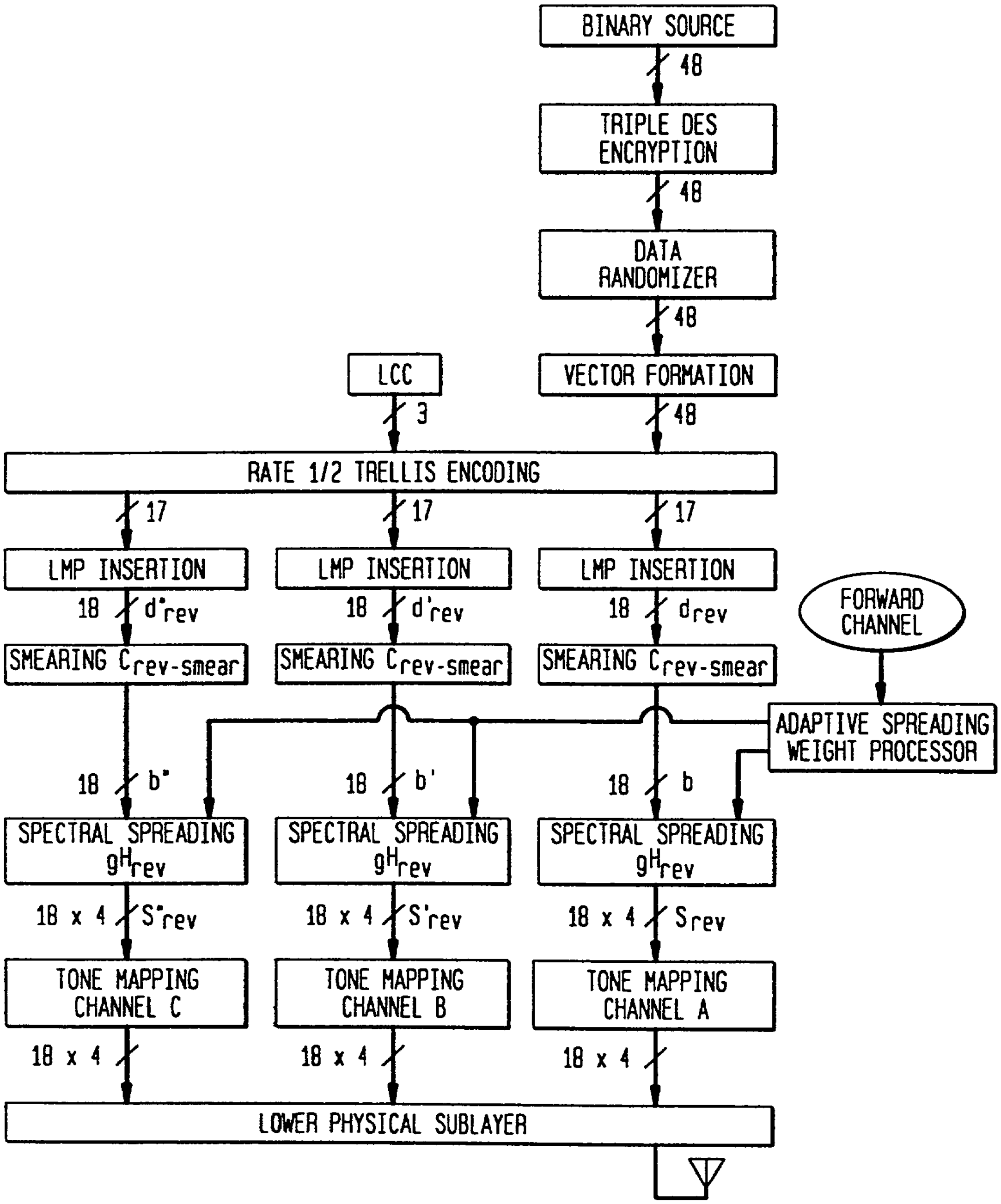

BINARY SOURCE
48
TRIPLE DES ENCRYPTION
48
DATA RANDOMIZER
48
LCC
VECTOR FORMATION
3
48
RATE 1/2 TRELLIS ENCODING
17
17
17
LMP INSERTION
LMP INSERTION
LMP INSERTION
FORWARD CHANNEL
18 d"rev
18 d'rev
18 drev
SMEARING Crev-smear
SMEARING Crev-smear
SMEARING Crev-smear
ADAPTIVE SPREADING WEIGHT PROCESSOR
18 b"
18 b'
18 b
SPECTRAL SPREADING gHrev
SPECTRAL SPREADING gHrev
SPECTRAL SPREADING gHrev
18 x 4 S"rev
18 x 4 S'rev
18 x 4 Srev
TONE MAPPING CHANNEL C
TONE MAPPING CHANNEL B
TONE MAPPING CHANNEL A
18 x 4
18 x 4
18 x 4
LOWER PHYSICAL SUBLAYER

FIG. 62

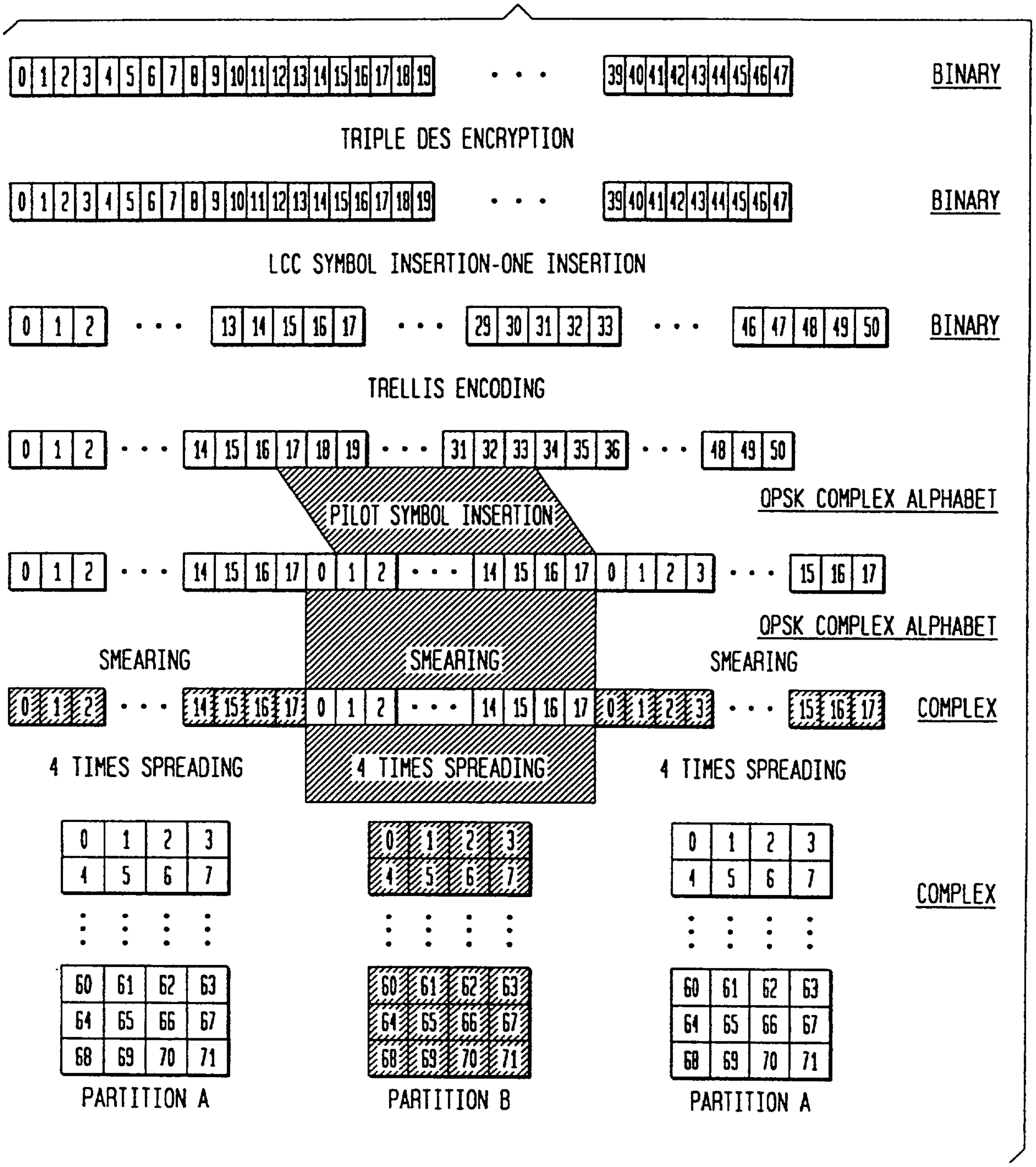

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 . . . 39 40 41 42 43 44 45 46 47
BINARY
TRIPLE DES ENCRYPTION
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 . . . 39 40 41 42 43 44 45 46 47
BINARY
LCC SYMBOL INSERTION-ONE INSERTION
0 1 2 . . . 13 14 15 16 17 . . . 29 30 31 32 33 . . . 46 47 48 49 50
BINARY
TRELLIS ENCODING
0 1 2 . . . 14 15 16 17 18 19 . . . 31 32 33 34 35 36 . . . 48 49 50
OPSK COMPLEX ALPHABET
PILOT SYMBOL INSERTION
0 1 2 . . . 14 15 16 17 0 1 2 . . . 14 15 16 17 0 1 2 3 . . . 15 16 17
OPSK COMPLEX ALPHABET
SMEARING
SMEARING
SMEARING
0 1 2 . . . 14 15 16 17 0 1 2 . . . 14 15 16 17 0 1 2 3 . . . 15 16 17
COMPLEX
4 TIMES SPREADING
4 TIMES SPREADING
4 TIMES SPREADING
0 1 2 3
4 5 6 7
60 61 62 63
64 65 66 67
68 69 70 71
PARTITION A
PARTITION B
PARTITION A
COMPLEX

FIG. 63

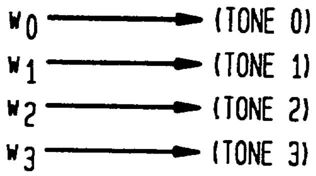

w_0
(TONE 0)
w_1
(TONE 1)
w_2
(TONE 2)
w_3
(TONE 3)

FIG. 65

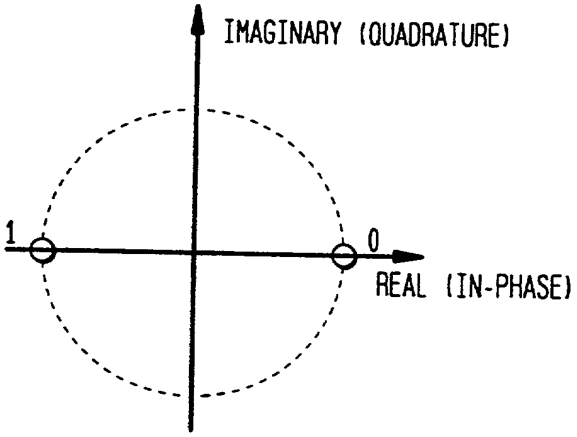

IMAGINARY (QUADRATURE)
1
0
REAL (IN-PHASE)

FIG. 64

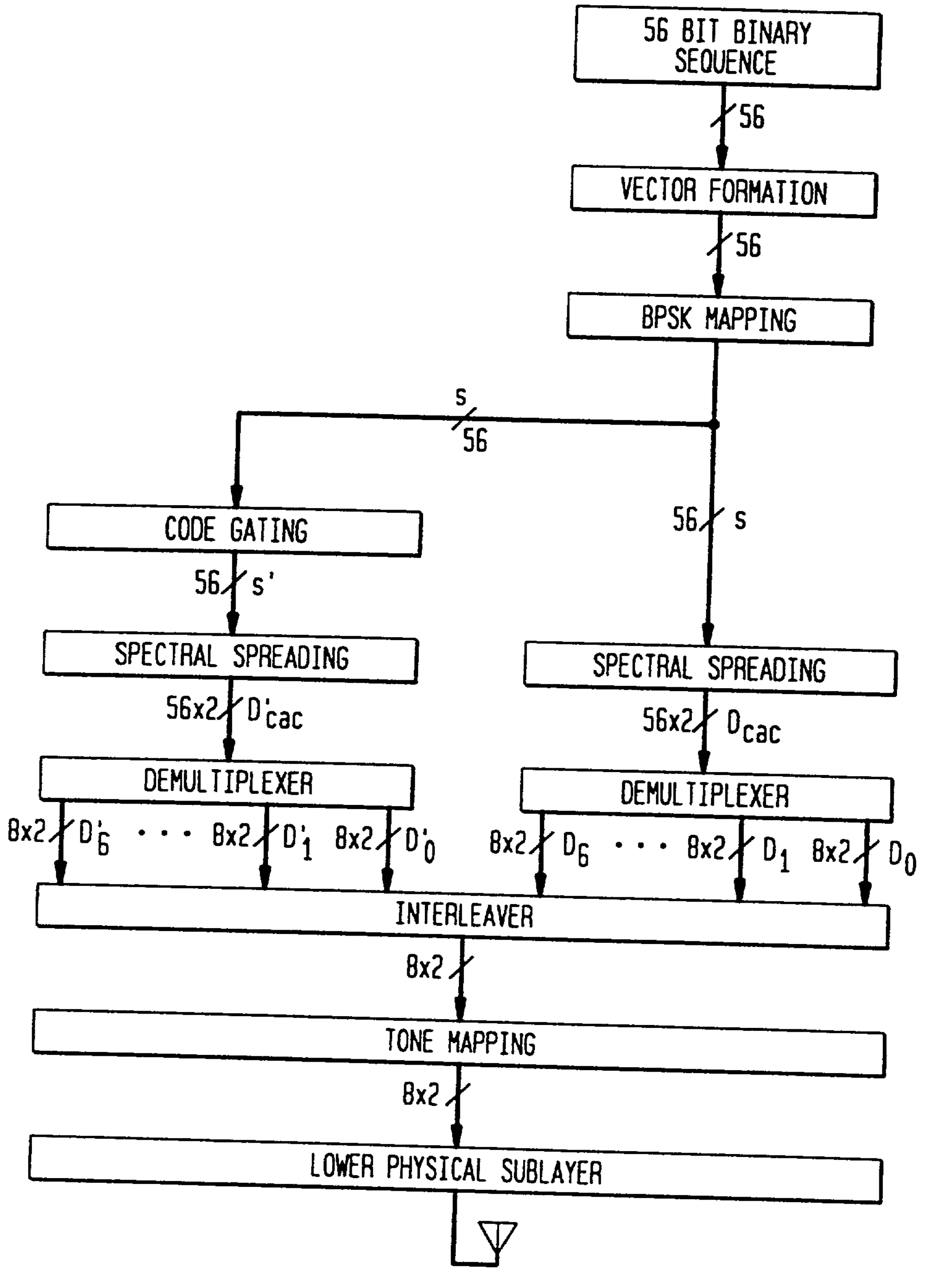

56 BIT BINARY SEQUENCE
56
VECTOR FORMATION
56
BPSK MAPPING
s
56
56 s
CODE GATING
56 s'
SPECTRAL SPREADING
56x2 D'cac
DEMULTIPLEXER
8x2 D'6 · · · 8x2 D'1 8x2 D'0
SPECTRAL SPREADING
56x2 Dcac
DEMULTIPLEXER
8x2 D6 · · · 8x2 D1 8x2 D0
INTERLEAVER
8x2
TONE MAPPING
8x2
LOWER PHYSICAL SUBLAYER

FIG. 65'

BIT	SIGNAL MAPPING	
	IN PHASE	QUADRATURE
0	1	0
1	-1	0

FIG. 66

	BURST NUMBER													
	0	1	2	3	4	5	6	7	8	9	10	11	12	13
MATRIX	D_0	D_1	D_2	D_3	D_4	D_5	D_6	D'_6	D'_5	D'_4	D'_3	D'_2	D'_1	D'_0

FIG. 67

		COLUMN NUMBER	
		0	1
ROW NUMBER	0	$CAC_{ij}(0)$[a]	$CAC_{ij}(8)$
	1	$CAC_{ij}(1)$	$CAC_{ij}(9)$
	2	$CAC_{ij}(2)$	$CAC_{ij}(10)$
	3	$CAC_{ij}(3)$	$CAC_{ij}(11)$
	4	$CAC_{ij}(4)$	$CAC_{ij}(12)$
	5	$CAC_{ij}(5)$	$CAC_{ij}(13)$
	6	$CAC_{ij}(6)$	$CAC_{ij}(14)$
	7	$CAC_{ij}(7)$	$CAC_{ij}(15)$

[a] i IS THE SUBBAND PAIR INDEX (0,1,2,OR 3) AND i IS THE CAC ID (0 OR 1)

FIG. 68

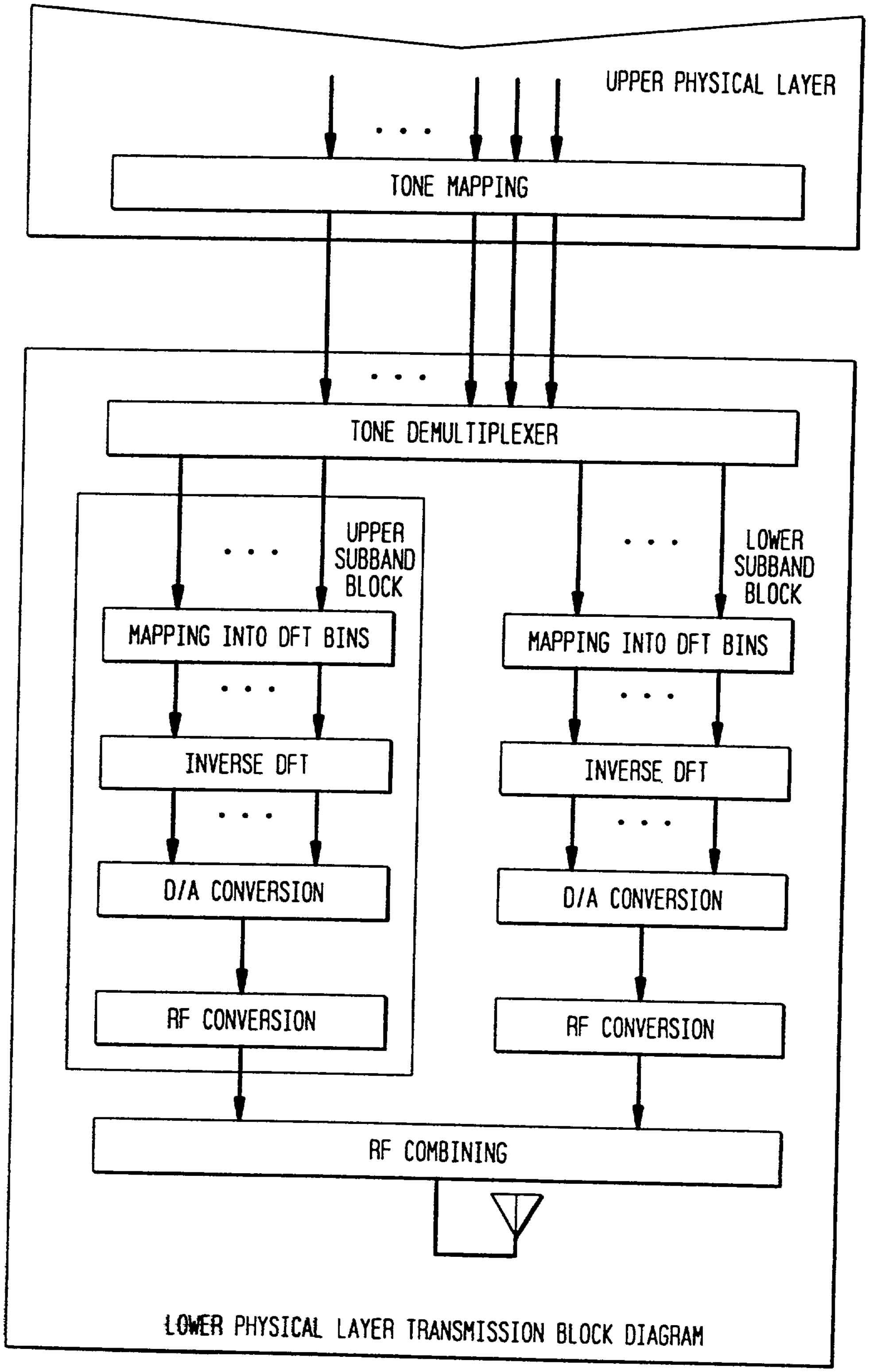
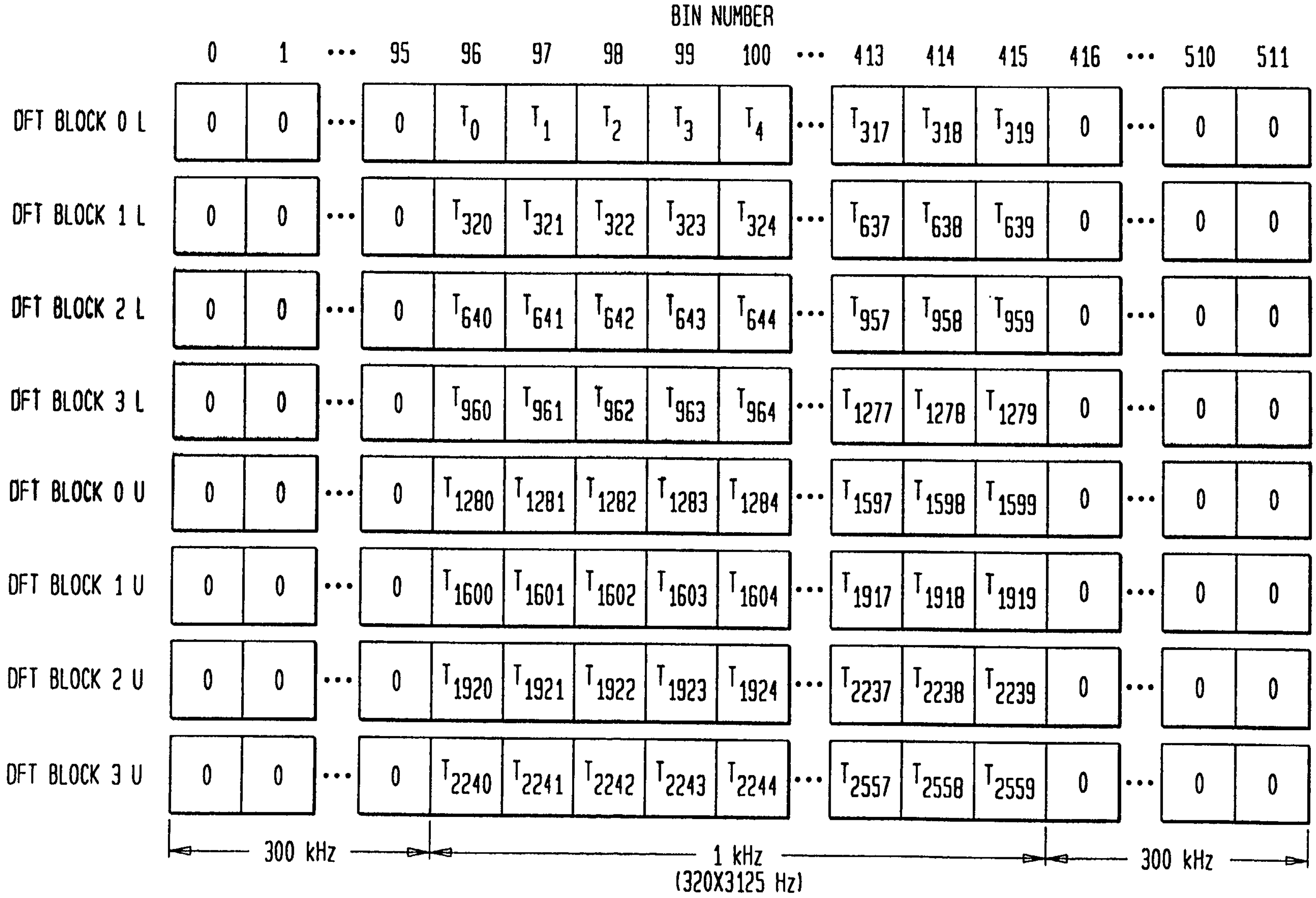

UPPER PHYSICAL LAYER
TONE MAPPING
TONE DEMULTIPLEXER
UPPER SUBBAND BLOCK
LOWER SUBBAND BLOCK
MAPPING INTO DFT BINS
MAPPING INTO DFT BINS
INVERSE DFT
INVERSE DFT
D/A CONVERSION
D/A CONVERSION
RF CONVERSION
RF CONVERSION
RF COMBINING
LOWER PHYSICAL LAYER TRANSMISSION BLOCK DIAGRAM

FIG. 69

			BIN NUMBER		
			BIN 0 TO BIN 95	BIN 96 TO BIN 415	BIN 416 TO BIN 511
DFT PAIR	0	LOWER	UNUSED	T_{0} TO T_{319}	UNUSED
		UPPER		T_{1280} TO T_{1599}	
	1	LOWER		T_{320} TO T_{639}	
		UPPER		T_{1600} TO T_{1919}	
	2	LOWER		T_{640} TO T_{959}	
		UPPER		T_{1920} TO T_{2239}	
	3	LOWER		T_{960} TO T_{1279}	
		UPPER		T_{2240} TO T_{2559}	

FIG. 70



BIN NUMBER

	0	1	···	95	96	97	98	99	100	···	413	414	415	416	···	510	511
DFT BLOCK 0 L	0	0	···	0	T_0	T_1	T_2	T_3	T_4	···	T_{317}	T_{318}	T_{319}	0	···	0	0
DFT BLOCK 1 L	0	0	···	0	T_{320}	T_{321}	T_{322}	T_{323}	T_{324}	···	T_{637}	T_{638}	T_{639}	0	···	0	0
DFT BLOCK 2 L	0	0	···	0	T_{640}	T_{641}	T_{642}	T_{643}	T_{644}	···	T_{957}	T_{958}	T_{959}	0	···	0	0
DFT BLOCK 3 L	0	0	···	0	T_{960}	T_{961}	T_{962}	T_{963}	T_{964}	···	T_{1277}	T_{1278}	T_{1279}	0	···	0	0
DFT BLOCK 0 U	0	0	···	0	T_{1280}	T_{1281}	T_{1282}	T_{1283}	T_{1284}	···	T_{1597}	T_{1598}	T_{1599}	0	···	0	0
DFT BLOCK 1 U	0	0	···	0	T_{1600}	T_{1601}	T_{1602}	T_{1603}	T_{1604}	···	T_{1917}	T_{1918}	T_{1919}	0	···	0	0
DFT BLOCK 2 U	0	0	···	0	T_{1920}	T_{1921}	T_{1922}	T_{1923}	T_{1924}	···	T_{2237}	T_{2238}	T_{2239}	0	···	0	0
DFT BLOCK 3 U	0	0	···	0	T_{2240}	T_{2241}	T_{2242}	T_{2243}	T_{2244}	···	T_{2557}	T_{2558}	T_{2559}	0	···	0	0

FIG. 71

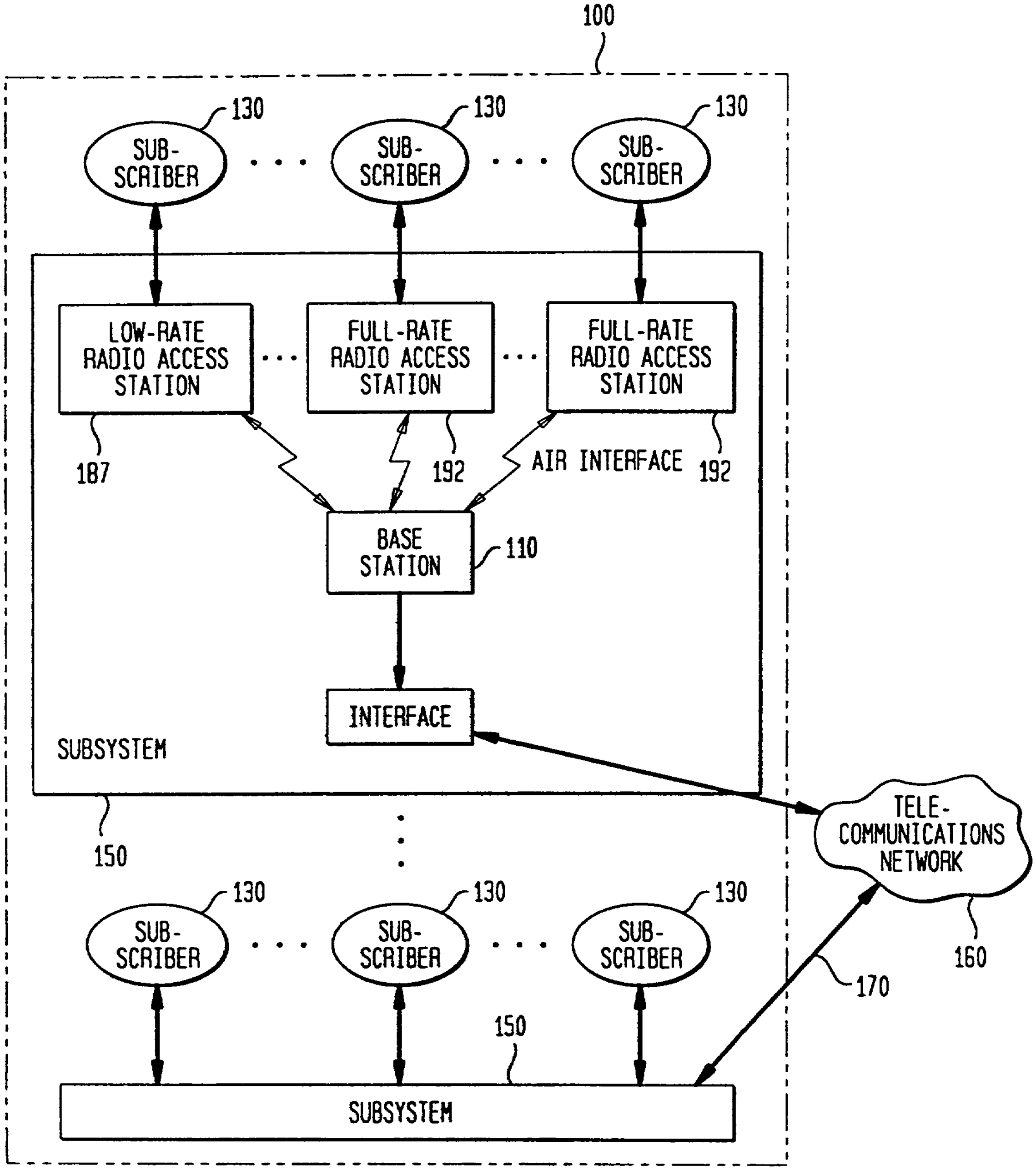

100
130
SUB-SCRIBER
130
SUB-SCRIBER
130
SUB-SCRIBER
LOW-RATE RADIO ACCESS STATION
FULL-RATE RADIO ACCESS STATION
FULL-RATE RADIO ACCESS STATION
187
192
AIR INTERFACE
192
BASE STATION
110
INTERFACE
SUBSYSTEM
150
TELE-COMMUNICATIONS NETWORK
160
130
SUB-SCRIBER
130
SUB-SCRIBER
130
SUB-SCRIBER
170
150
SUBSYSTEM

FIG. 72

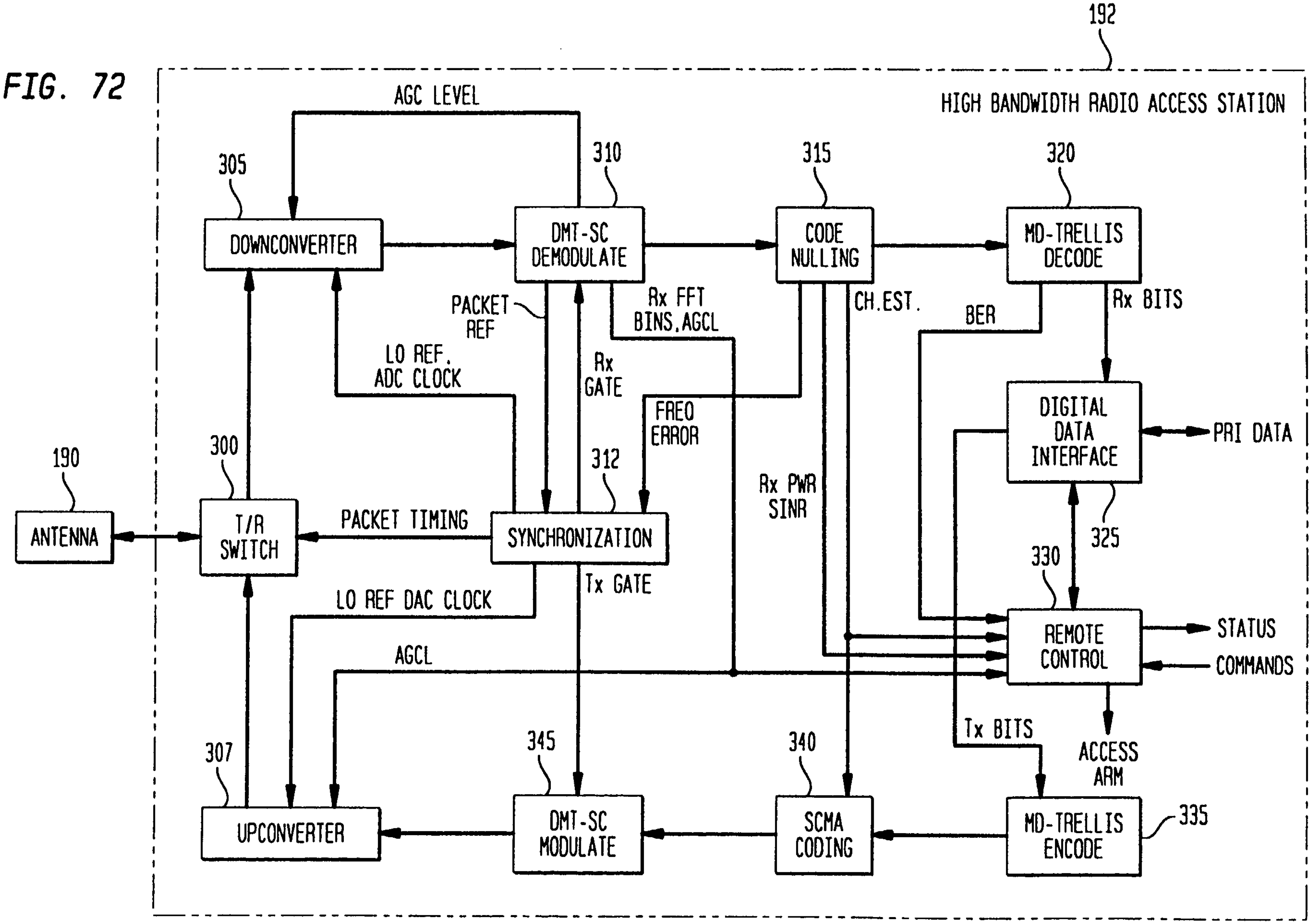

192
HIGH BANDWIDTH RADIO ACCESS STATION
AGC LEVEL
305
DOWNCONVERTER
310
DMT-SC
DEMODULATE
315
CODE
NULLING
320
MD-TRELLIS
DECODE
PACKET
REF
Rx FFT
BINS,AGCL
CH.EST.
BER
Rx BITS
LO REF,
ADC CLOCK
Rx
GATE
FREQ
ERROR
DIGITAL
DATA
INTERFACE
PRI DATA
190
ANTENNA
300
T/R
SWITCH
PACKET TIMING
312
SYNCHRONIZATION
Rx PWR
SINR
325
330
LO REF DAC CLOCK
Tx GATE
REMOTE
CONTROL
STATUS
COMMANDS
AGCL
Tx BITS
ACCESS
ARM
307
UPCONVERTER
345
DMT-SC
MODULATE
340
SCMA
CODING
MD-TRELLIS
ENCODE
335

FIG. 73

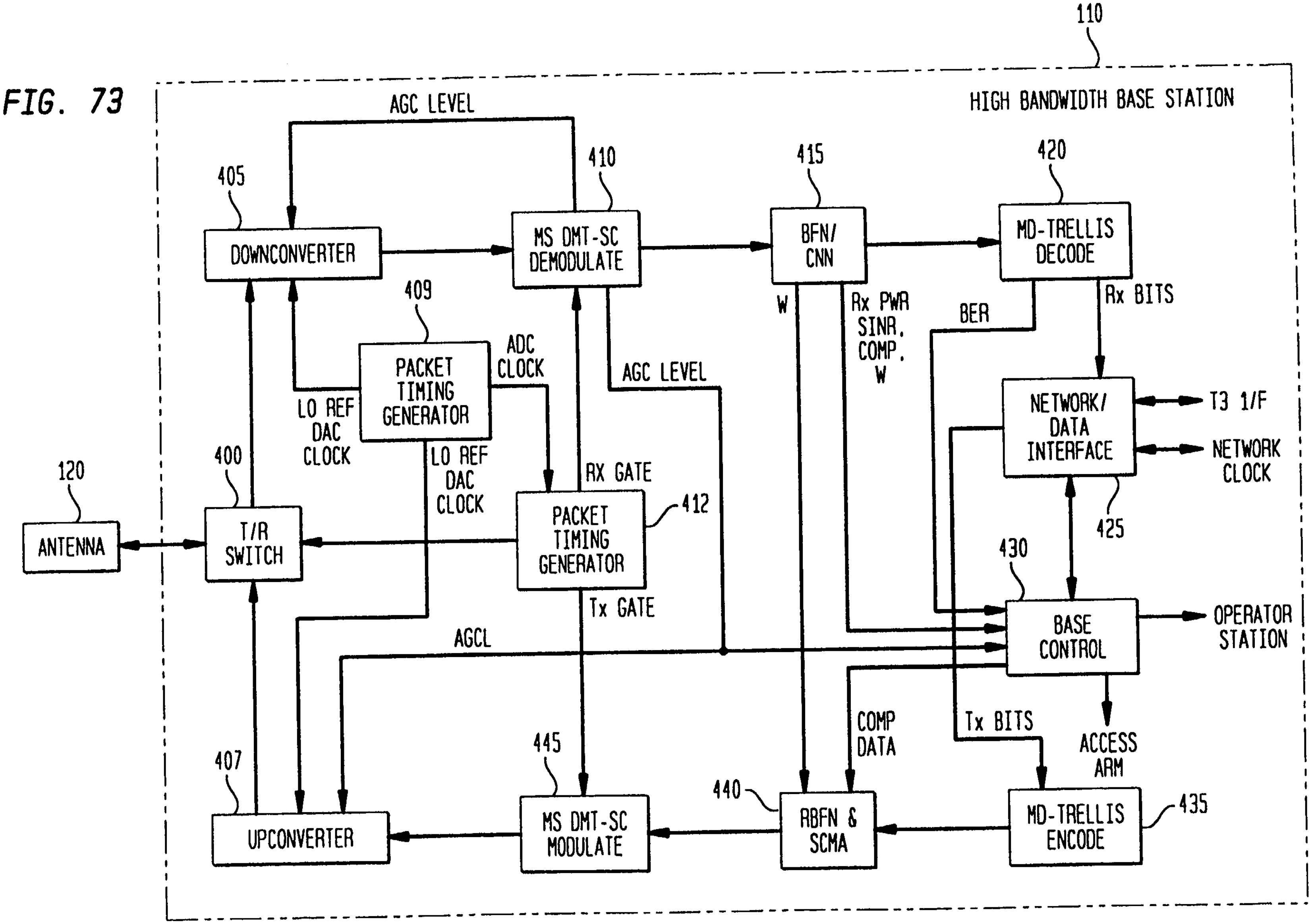

110
HIGH BANDWIDTH BASE STATION
AGC LEVEL
405
DOWNCONVERTER
410
MS DMT-SC DEMODULATE
415
BFN/ CNN
420
MD-TRELLIS DECODE
Rx BITS
BER
W
Rx PWR SINR, COMP, W
409
PACKET TIMING GENERATOR
ADC CLOCK
LO REF DAC CLOCK
LO REF DAC CLOCK
AGC LEVEL
NETWORK/ DATA INTERFACE
T3 1/F
NETWORK CLOCK
425
120
ANTENNA
400
T/R SWITCH
RX GATE
PACKET TIMING GENERATOR
412
430
BASE CONTROL
OPERATOR STATION
Tx GATE
AGCL
COMP DATA
Tx BITS
ACCESS ARM
407
UPCONVERTER
445
MS DMT-SC MODULATE
440
RBFN & SCMA
MD-TRELLIS ENCODE
435

FIG. 74

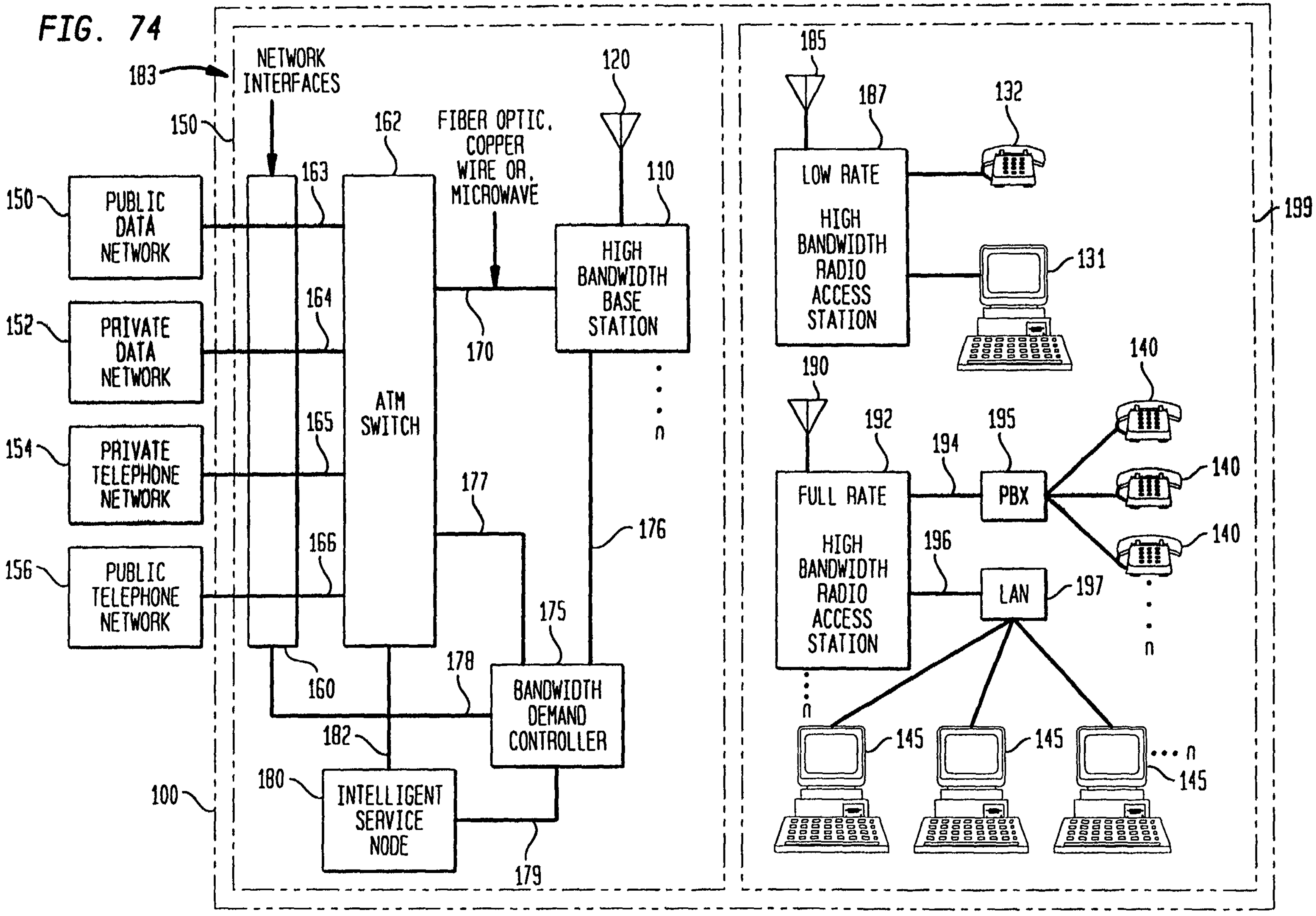

183
NETWORK INTERFACES
150
100
PUBLIC DATA NETWORK
150
PRIVATE DATA NETWORK
152
PRIVATE TELEPHONE NETWORK
154
PUBLIC TELEPHONE NETWORK
156
163
164
165
166
160
162
ATM SWITCH
FIBER OPTIC, COPPER WIRE OR, MICROWAVE
170
120
110
HIGH BANDWIDTH BASE STATION
n
176
177
175
BANDWIDTH DEMAND CONTROLLER
178
182
180
INTELLIGENT SERVICE NODE
179
199
185
187
LOW RATE
HIGH BANDWIDTH RADIO ACCESS STATION
132
131
190
192
FULL RATE
HIGH BANDWIDTH RADIO ACCESS STATION
194
195
PBX
140
140
140
n
196
LAN
197
n
145
145
145
n

FIG. 75

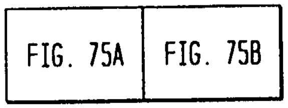


FIG. 75A

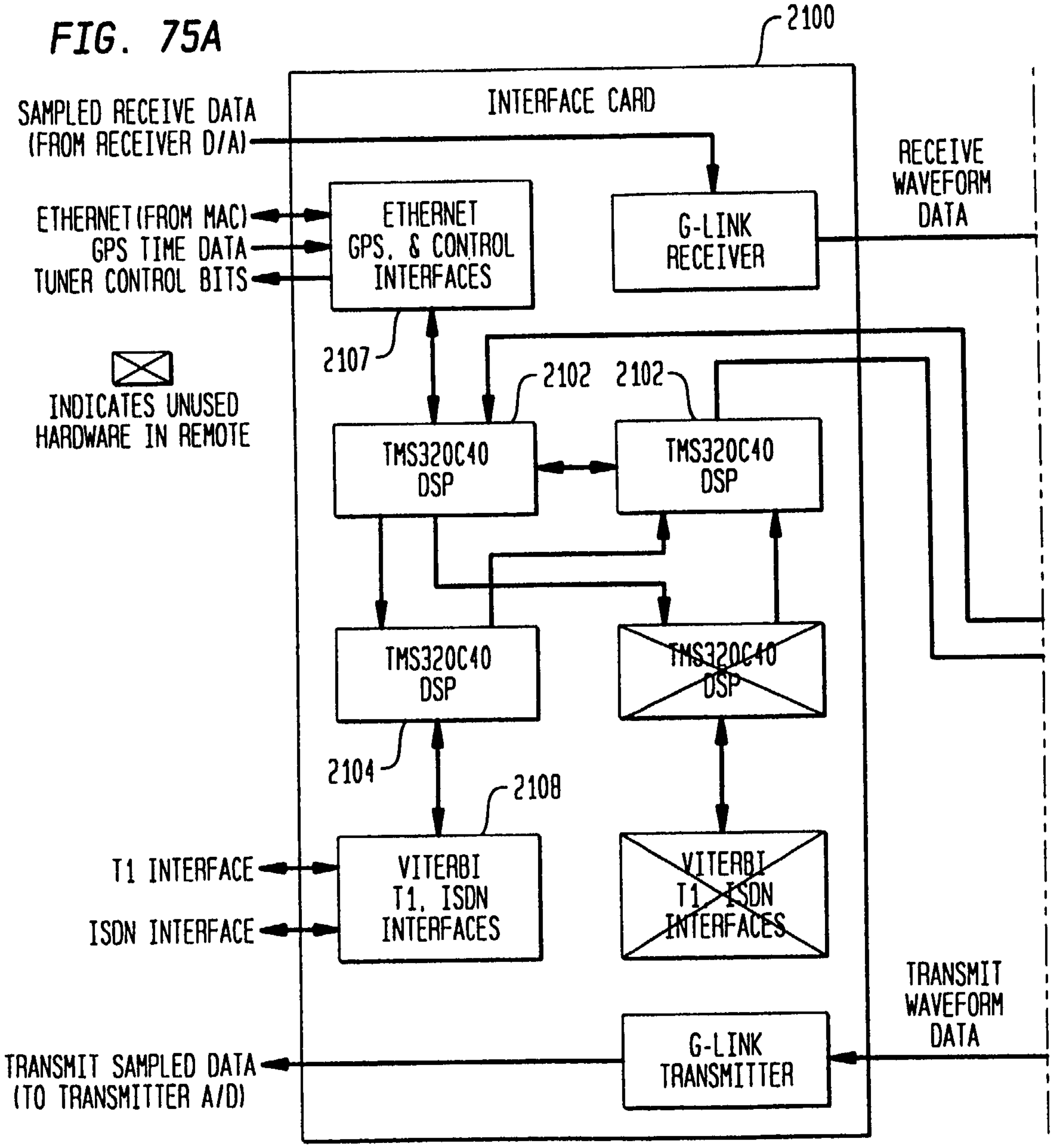


FIG. 75B

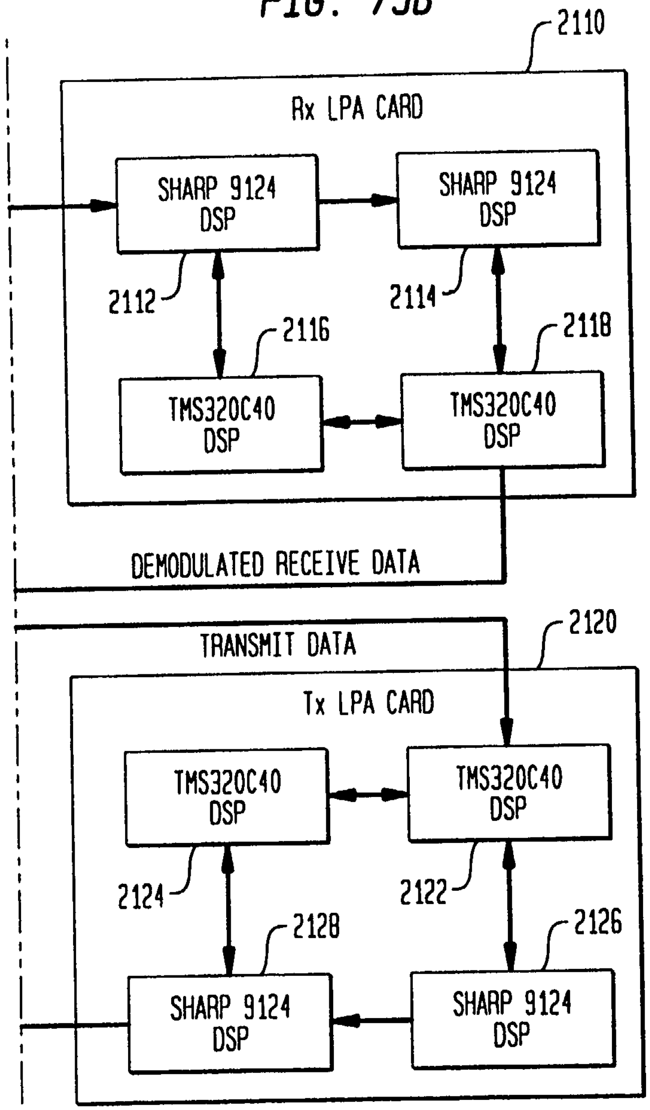

2110
Rx LPA CARD
SHARP 9124 DSP
SHARP 9124 DSP
2112
2114
2116
2118
TMS320C40 DSP
TMS320C40 DSP
DEMODULATED RECEIVE DATA
TRANSMIT DATA
2120
Tx LPA CARD
TMS320C40 DSP
TMS320C40 DSP
2124
2122
2128
2126
SHARP 9124 DSP
SHARP 9124 DSP

FIG. 76

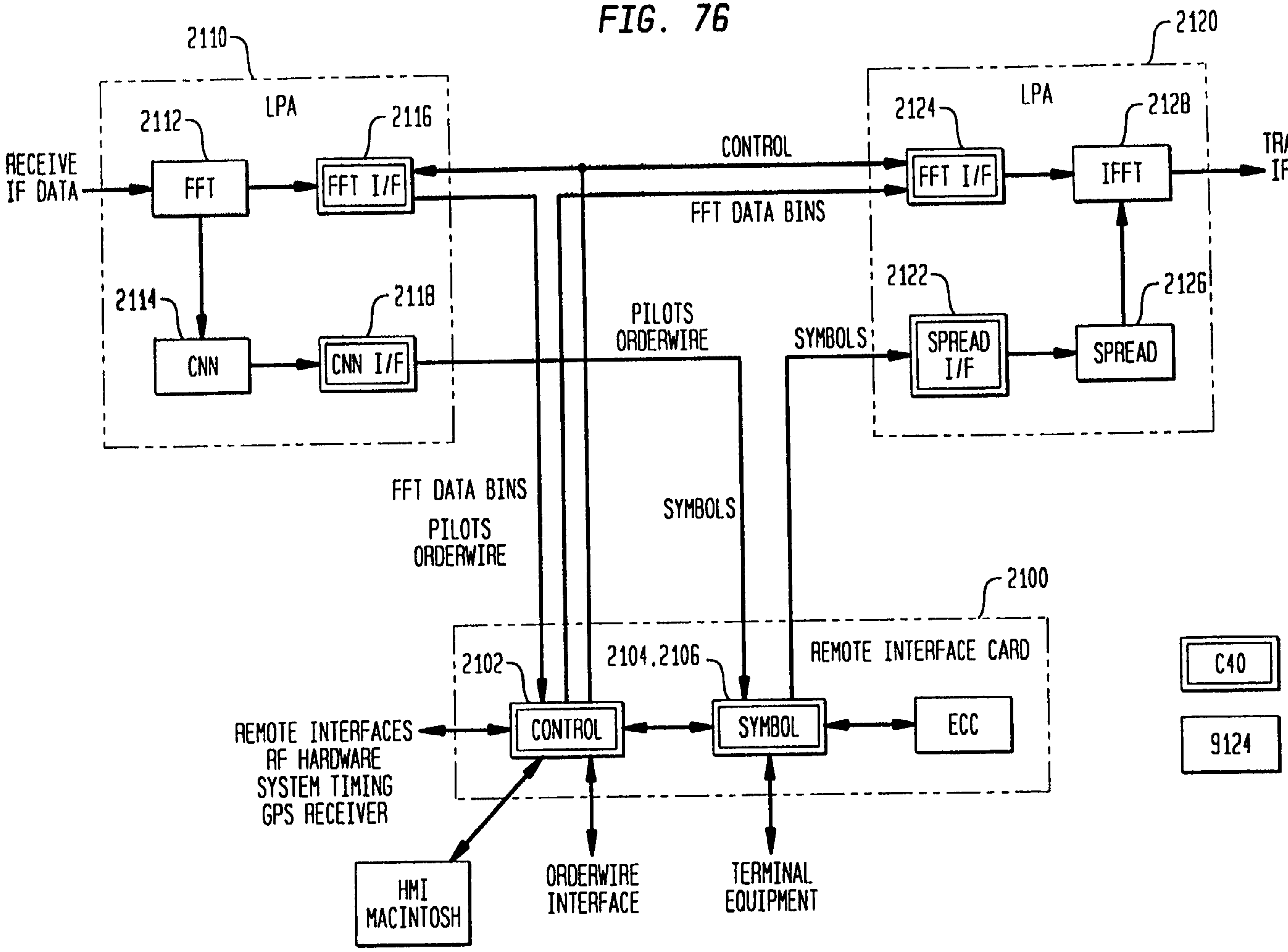

2110
LPA
2112
RECEIVE IF DATA
FFT
2116
FFT I/F
2114
CNN
2118
CNN I/F
CONTROL
FFT DATA BINS
PILOTS ORDERWIRE
SYMBOLS
2120
LPA
2124
FFT I/F
2128
IFFT
TRANSMIT IF DATA
2122
SPREAD I/F
2126
SPREAD
FFT DATA BINS
PILOTS ORDERWIRE
SYMBOLS
2100
REMOTE INTERFACE CARD
2102
CONTROL
2104,2106
SYMBOL
ECC
REMOTE INTERFACES
RF HARDWARE
SYSTEM TIMING
GPS RECEIVER
HMI MACINTOSH
ORDERWIRE INTERFACE
TERMINAL EQUIPMENT
C40
9124

FIG. 77A

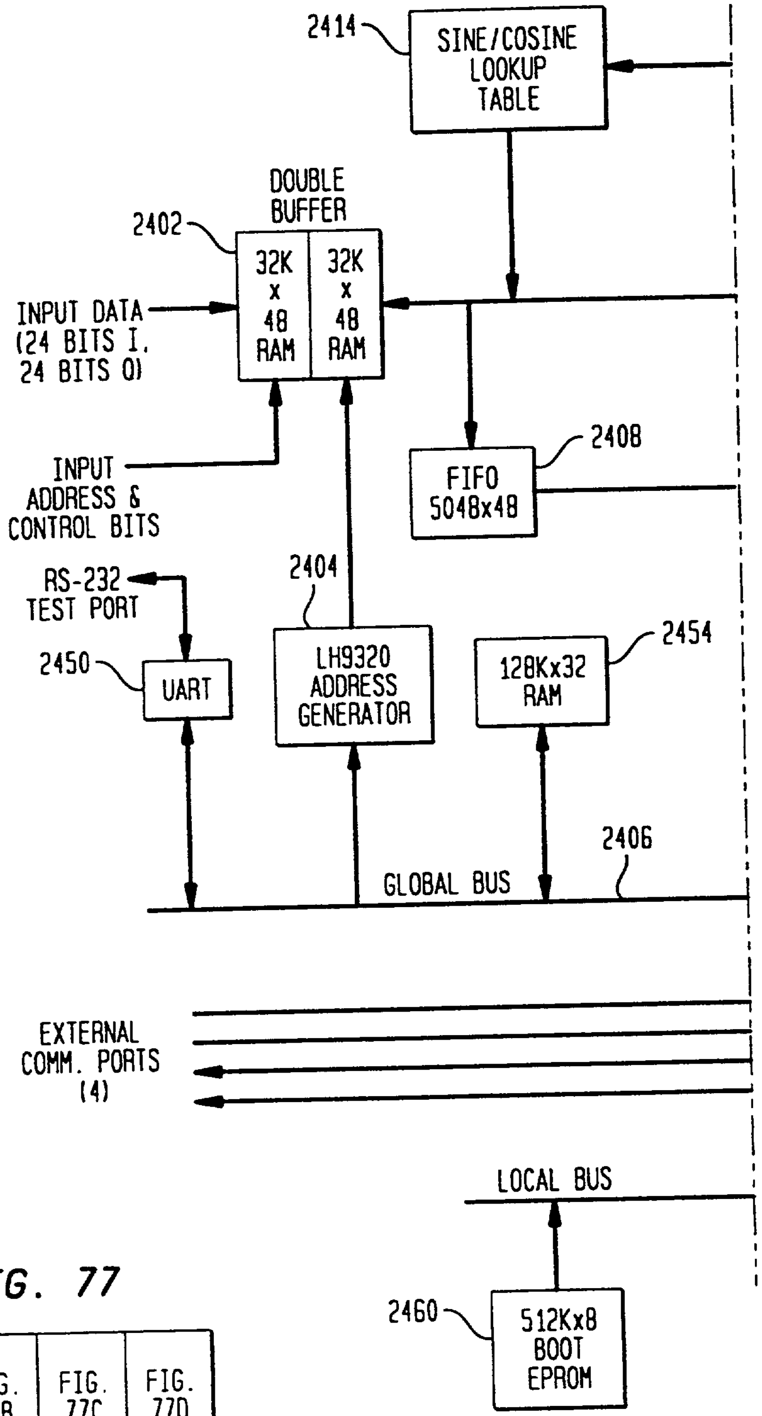


FIG. 77

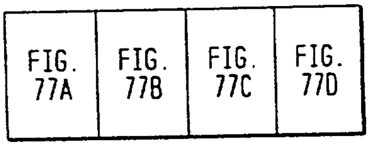


FIG. 77B

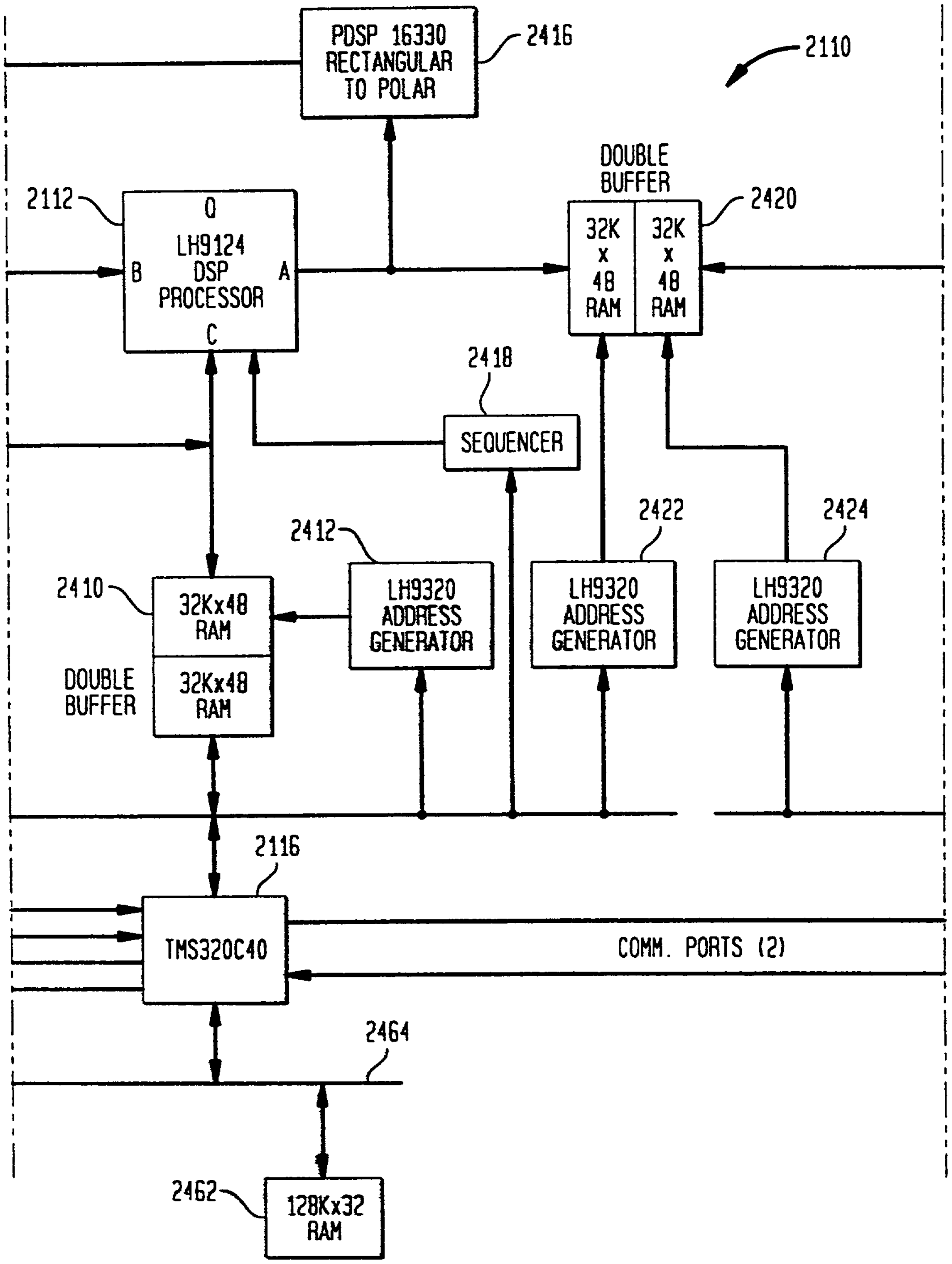
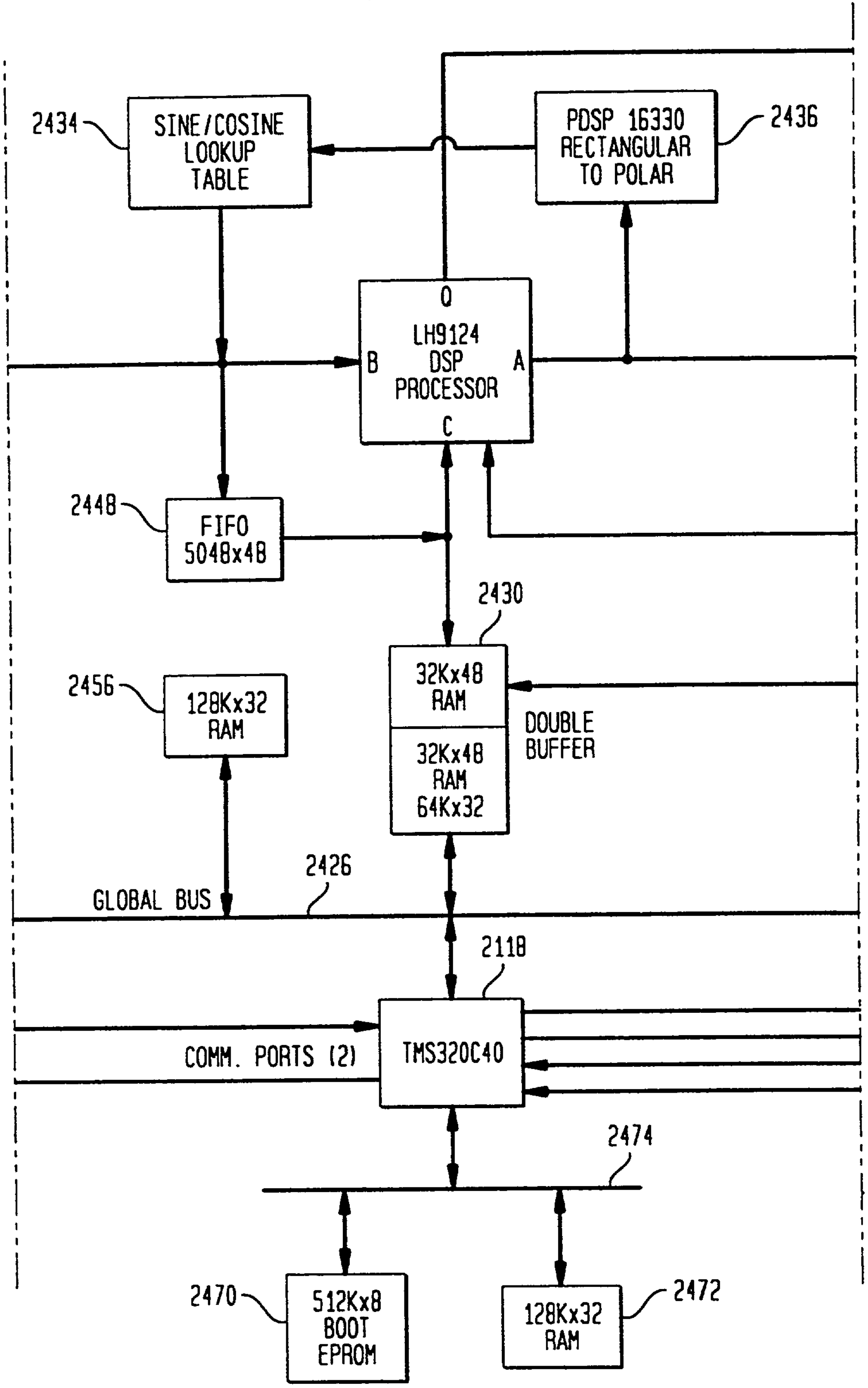

PDSP 16330 RECTANGULAR TO POLAR
2416
2110
DOUBLE BUFFER
2112
Q
LH9124 DSP PROCESSOR
B
A
C
32K x 48 RAM
32K x 48 RAM
2420
2418
SEQUENCER
2412
2422
2424
2410
32Kx48 RAM
32Kx48 RAM
DOUBLE BUFFER
LH9320 ADDRESS GENERATOR
LH9320 ADDRESS GENERATOR
LH9320 ADDRESS GENERATOR
2116
TMS320C40
COMM. PORTS (2)
2464
2462
128Kx32 RAM

FIG. 77C



2434
SINE/COSINE LOOKUP TABLE
PDSP 16330 RECTANGULAR TO POLAR
2436
Q
LH9124 DSP PROCESSOR
B
A
C
2448
FIFO 5048x48
2430
32Kx48 RAM
32Kx48 RAM 64Kx32
DOUBLE BUFFER
2456
128Kx32 RAM
2426
GLOBAL BUS
2118
TMS320C40
COMM. PORTS (2)
2474
2470
512Kx8 BOOT EPROM
2472
128Kx32 RAM

FIG. 77D

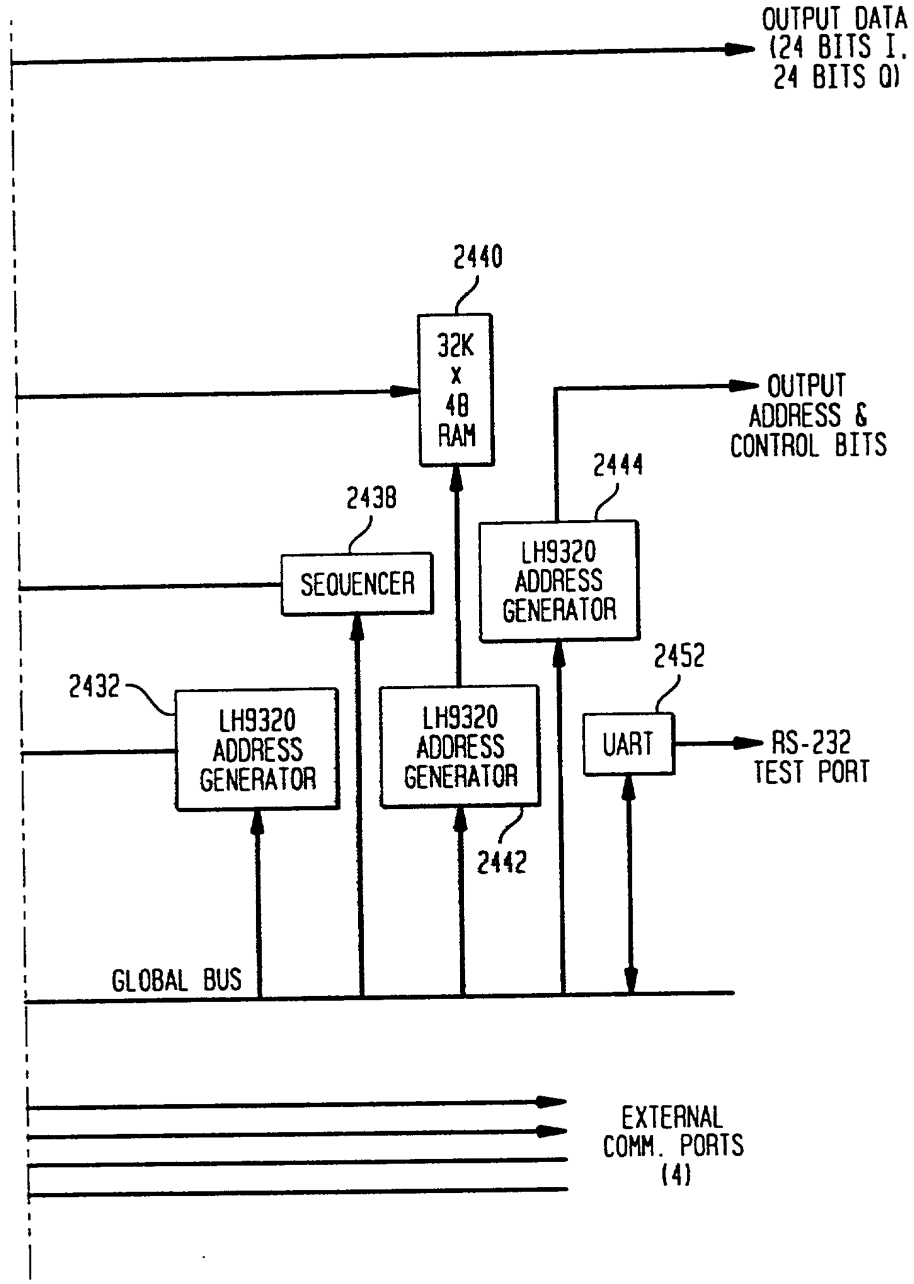

OUTPUT DATA (24 BITS I, 24 BITS Q)
2440
32K x 48 RAM
OUTPUT ADDRESS & CONTROL BITS
2444
2438
SEQUENCER
LH9320 ADDRESS GENERATOR
2452
2432
LH9320 ADDRESS GENERATOR
LH9320 ADDRESS GENERATOR
UART
RS-232 TEST PORT
2442
GLOBAL BUS
EXTERNAL COMM. PORTS (4)

FIG. 78A

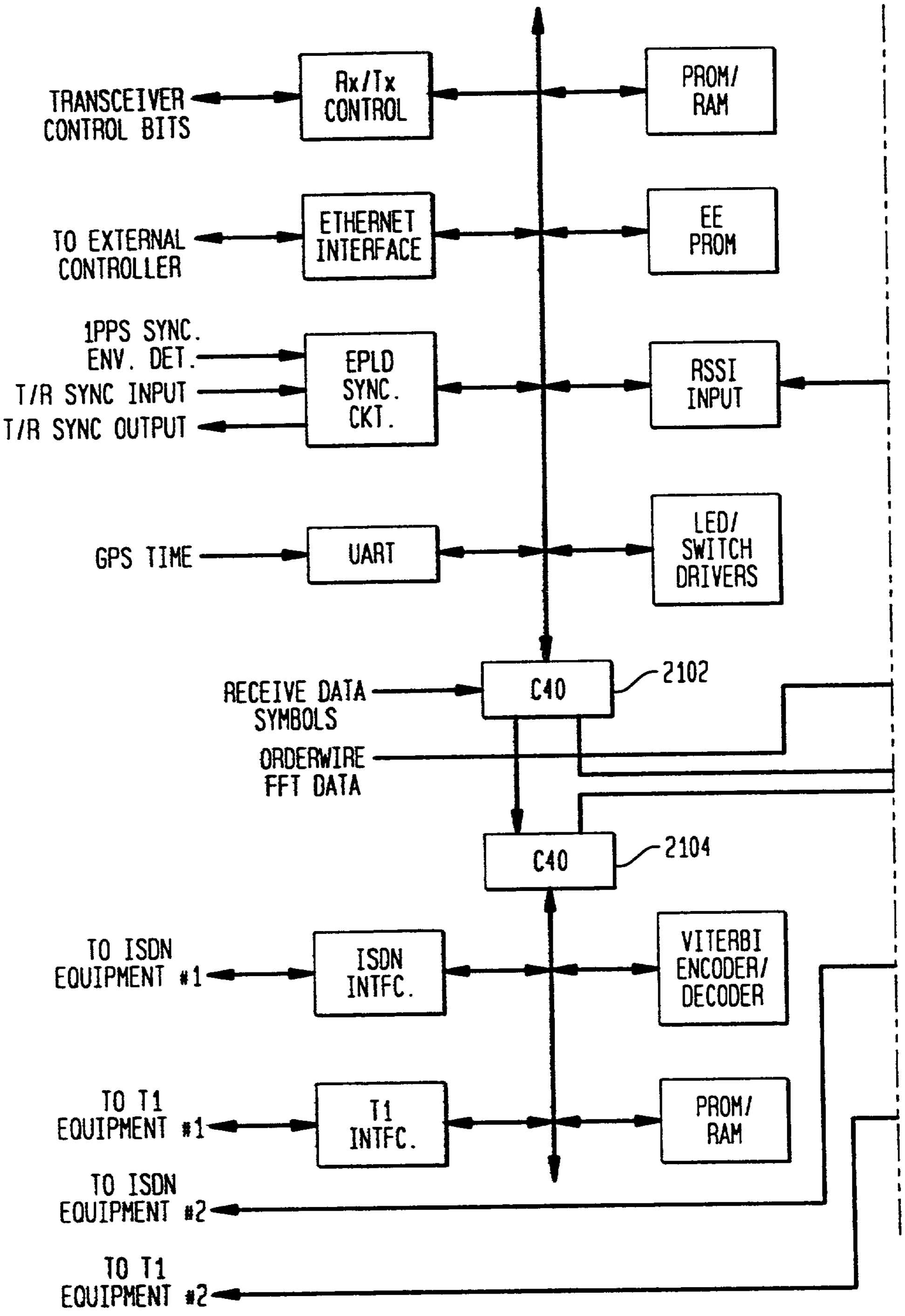


FIG. 78

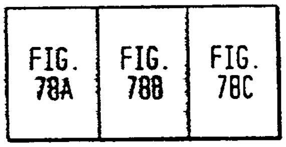


FIG. 78B

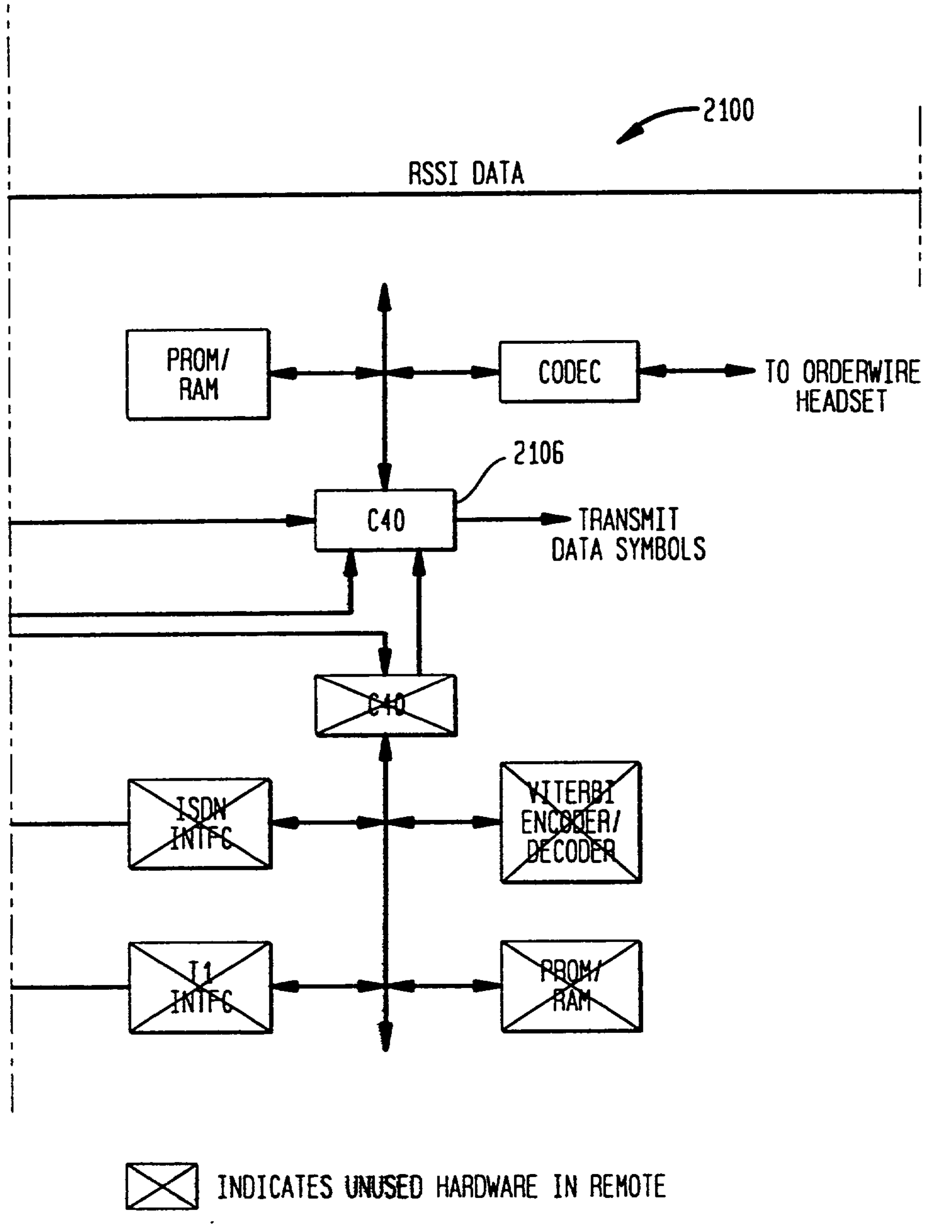

2100
RSSI DATA
PROM/
RAM
CODEC
TO ORDERWIRE
HEADSET
2106
C40
TRANSMIT
DATA SYMBOLS
C40
ISDN
INTFC
VITERBI
ENCODER/
DECODER
T1
INTFC
PROM/
RAM
INDICATES UNUSED HARDWARE IN REMOTE

FIG. 78C

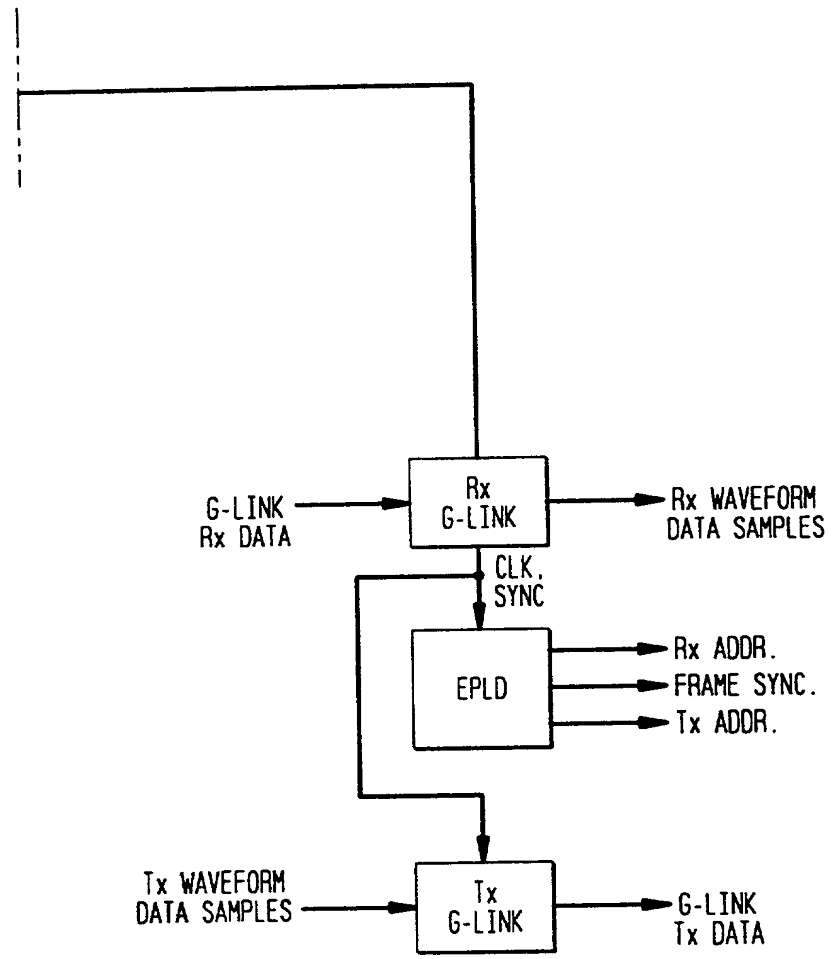

G-LINK
Rx DATA
Rx
G-LINK
Rx WAVEFORM
DATA SAMPLES
CLK,
SYNC
EPLD
Rx ADDR.
FRAME SYNC.
Tx ADDR.
Tx WAVEFORM
DATA SAMPLES
Tx
G-LINK
G-LINK
Tx DATA

FIG. 79A

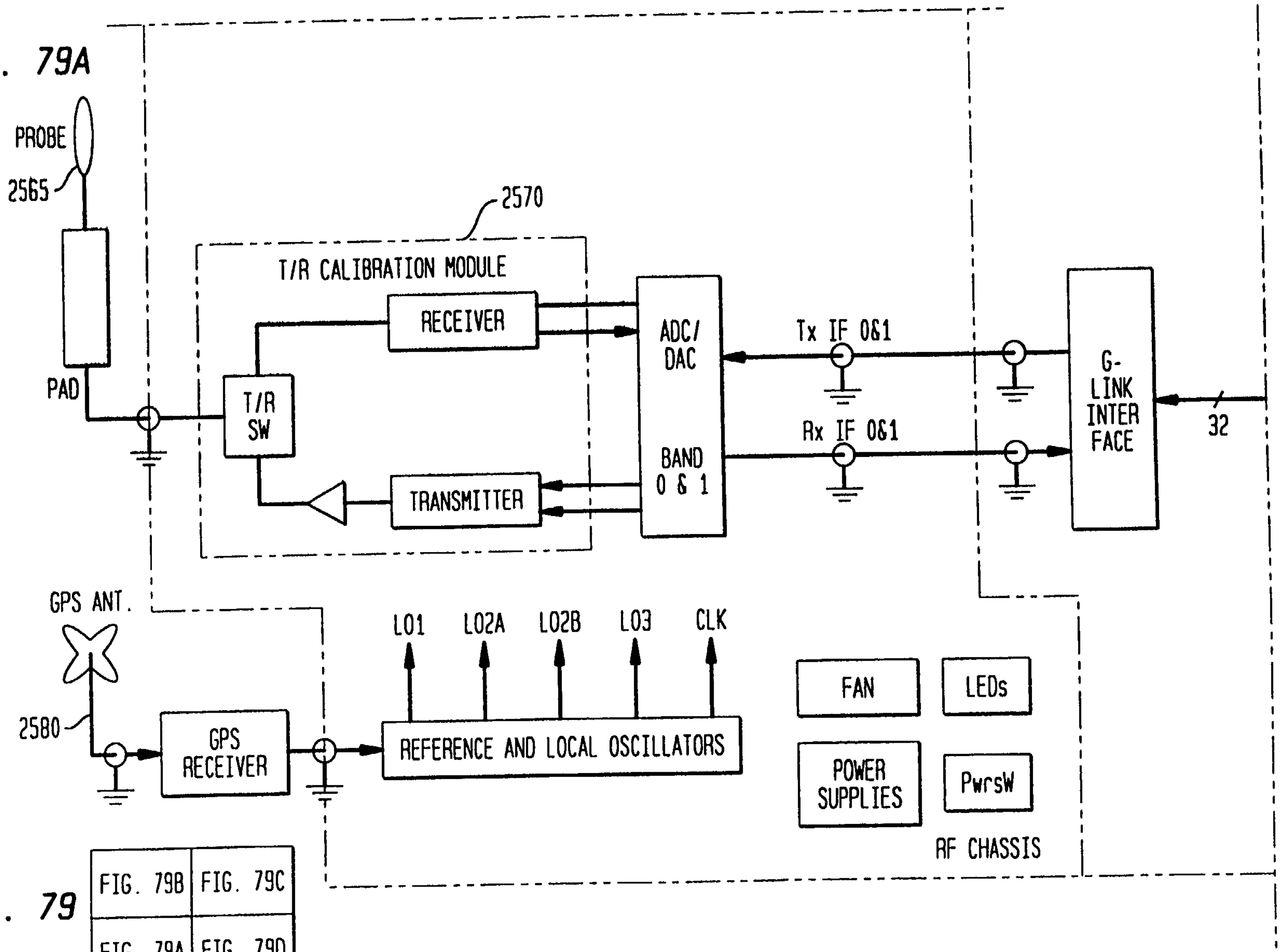


FIG. 79

FIG. 79B	FIG. 79C
FIG. 79A	FIG. 79D

FIG. 79B

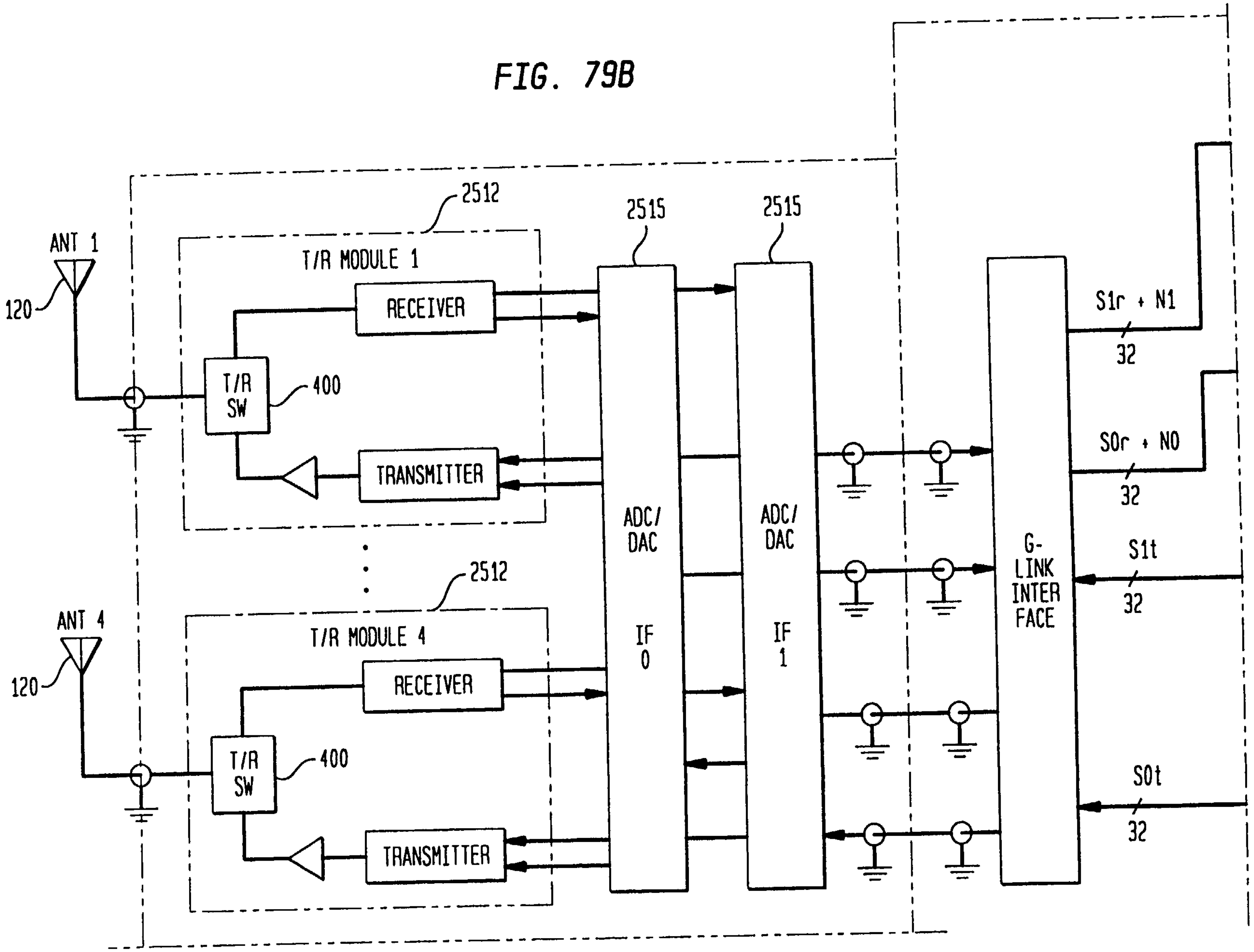
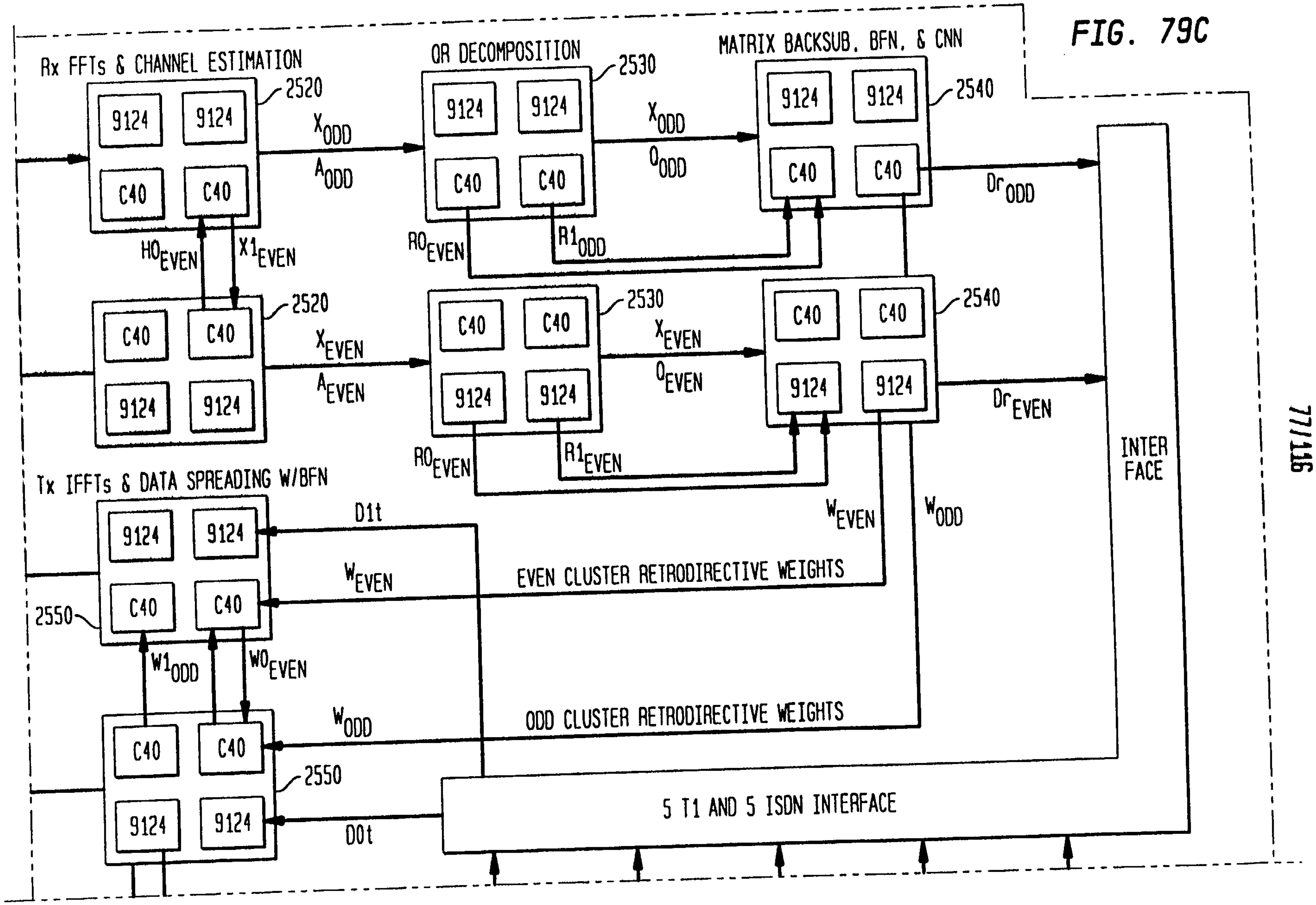

2512
T/R MODULE 1
ANT 1
120
RECEIVER
T/R
SW
400
TRANSMITTER
2512
T/R MODULE 4
ANT 4
120
RECEIVER
T/R
SW
400
TRANSMITTER
2515
ADC/
DAC
IF
0
2515
ADC/
DAC
IF
1
G-
LINK
INTER
FACE
S1r + N1
32
S0r + N0
32
S1t
32
S0t
32

FIG. 79C



Rx FFTs & CHANNEL ESTIMATION
2520
9124
9124
C40
C40
X_{ODD}
A_{ODD}
HO_{EVEN}
$X1_{EVEN}$
2520
C40
C40
9124
9124
X_{EVEN}
A_{EVEN}
QR DECOMPOSITION
2530
9124
9124
C40
C40
RO_{EVEN}
$R1_{ODD}$
X_{ODD}
O_{ODD}
2530
C40
C40
9124
9124
X_{EVEN}
O_{EVEN}
RO_{EVEN}
$R1_{EVEN}$
MATRIX BACKSUB. BFN. & CNN
2540
9124
9124
C40
C40
Dr_{ODD}
2540
C40
C40
9124
9124
Dr_{EVEN}
W_{EVEN}
W_{ODD}
INTER FACE
Tx IFFTs & DATA SPREADING W/BFN
9124
9124
C40
C40
2550
D1t
W_{EVEN}
EVEN CLUSTER RETRODIRECTIVE WEIGHTS
$W1_{ODD}$
WO_{EVEN}
C40
C40
9124
9124
2550
W_{ODD}
ODD CLUSTER RETRODIRECTIVE WEIGHTS
D0t
5 T1 AND 5 ISDN INTERFACE

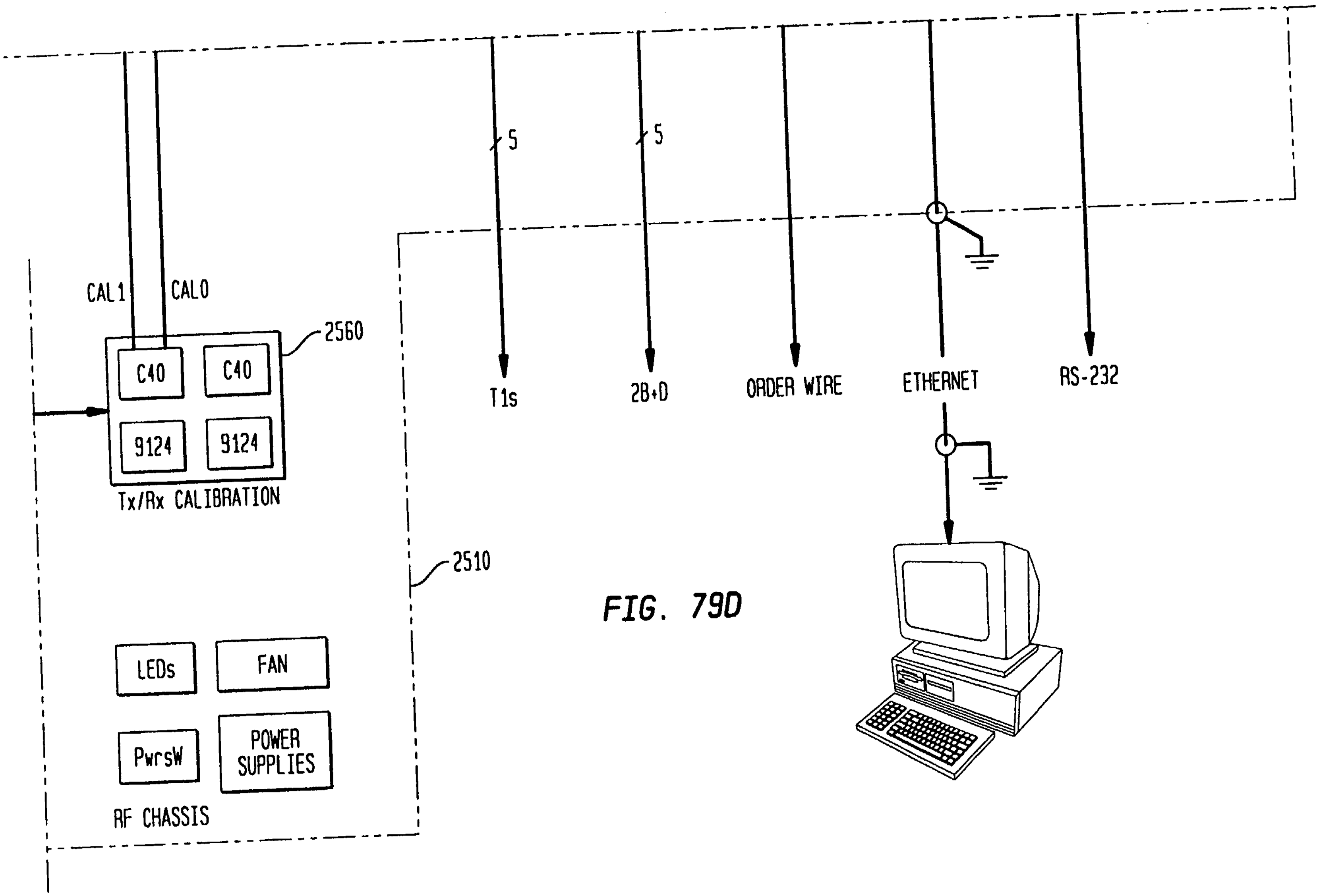

CAL1
CAL0
2560
C40
C40
9124
9124
Tx/Rx CALIBRATION
5
5
T1s
2B+D
ORDER WIRE
ETHERNET
RS-232
2510
LEDs
FAN
PwrsW
POWER SUPPLIES
RF CHASSIS

FIG. 79D

FIG. 80A

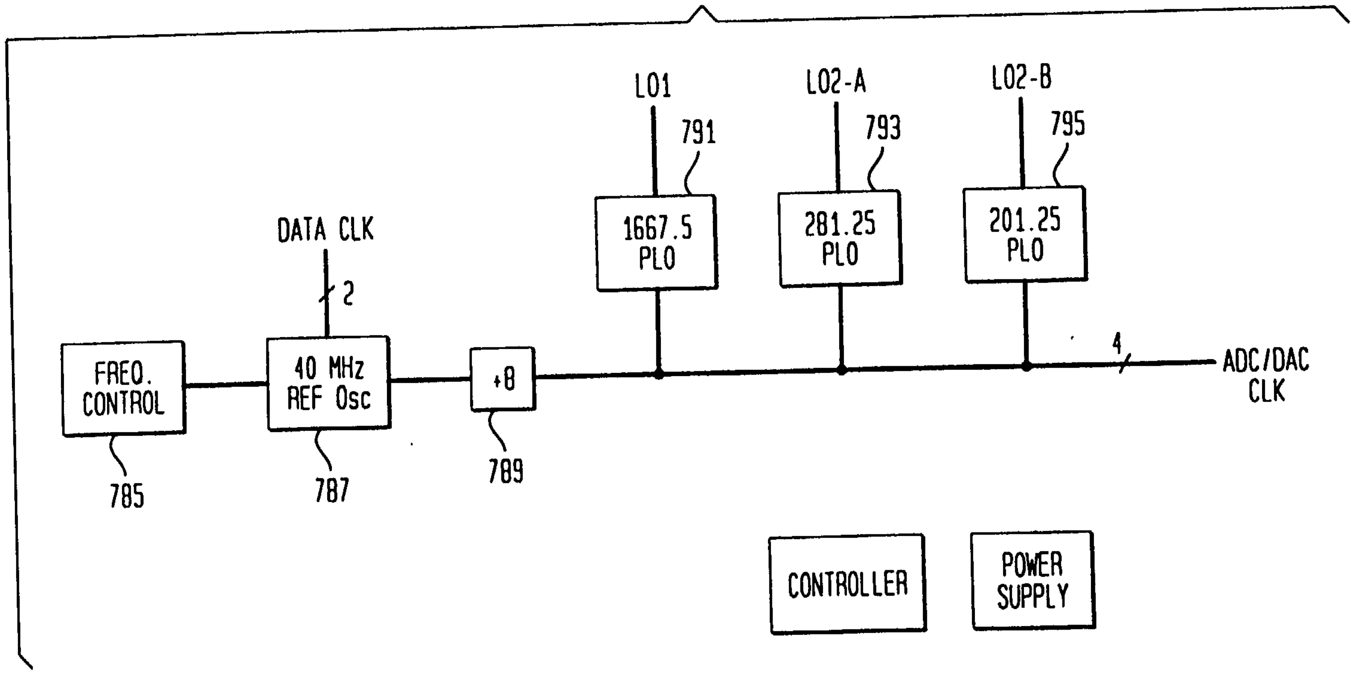

L01
791
L02-A
793
L02-B
795
DATA CLK
2
1667.5 PLO
281.25 PLO
201.25 PLO
FREQ. CONTROL
40 MHz REF Osc
÷8
4
ADC/DAC CLK
785
787
789
CONTROLLER
POWER SUPPLY

FIG. 80-1

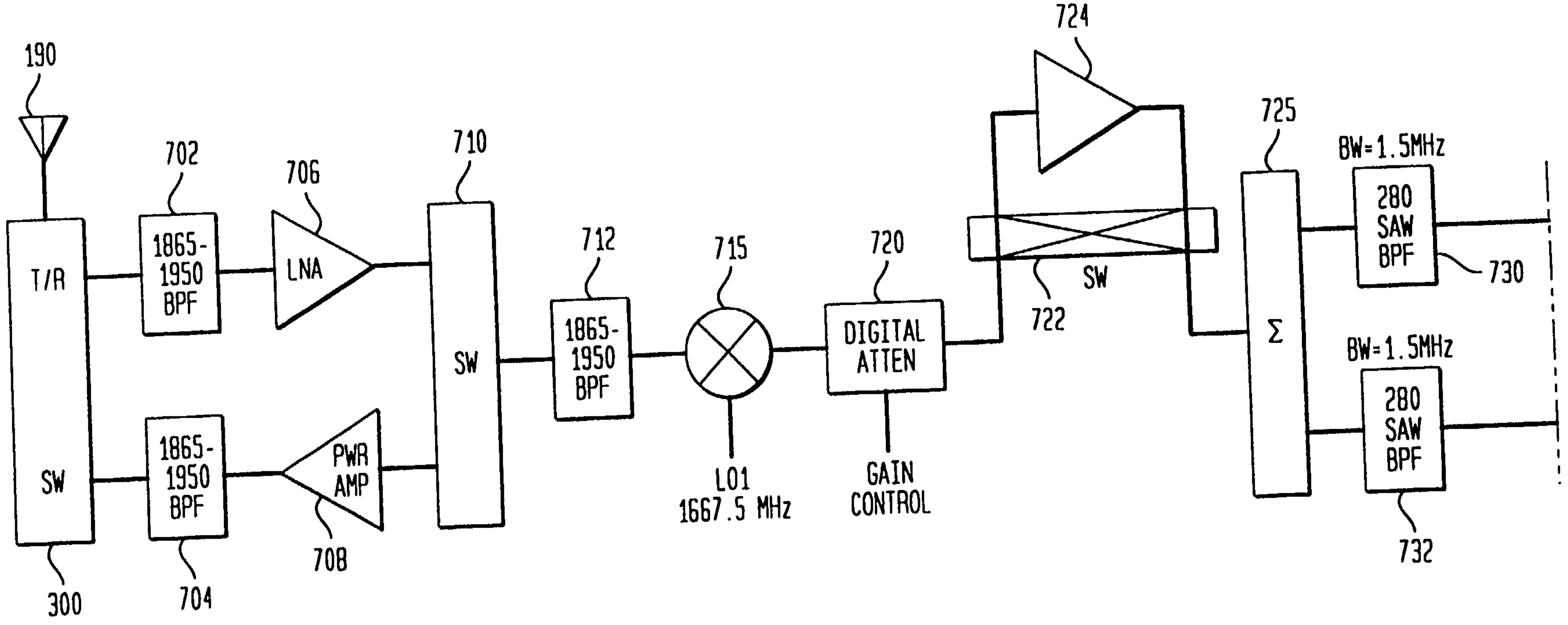


FIG. 80

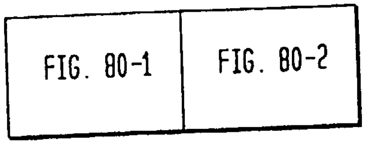


FIG. 80-2

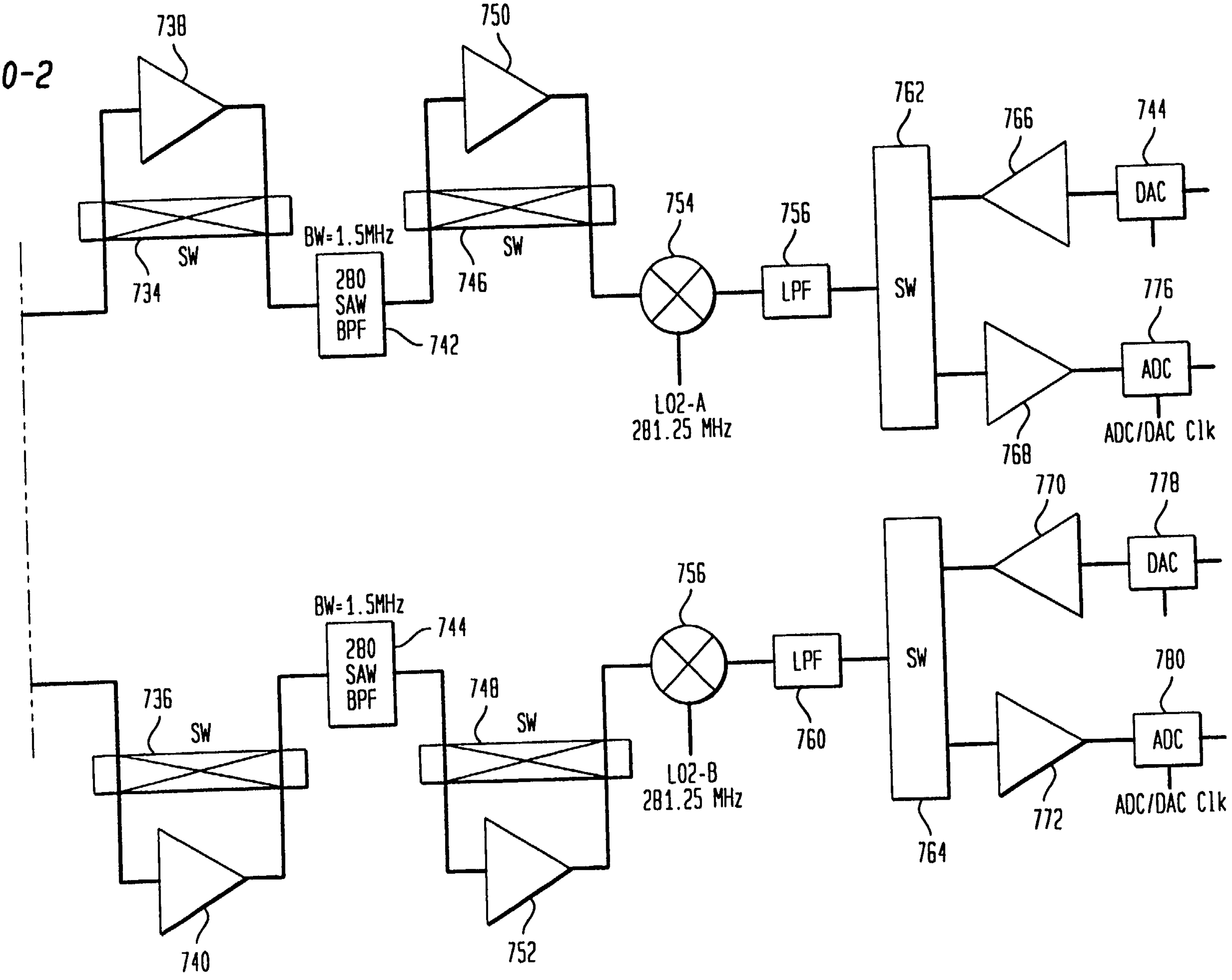

738
750
734
SW
BW=1.5MHz
280
SAW
BPF
742
746
SW
754
LO2-A
281.25 MHz
756
LPF
762
SW
766
744
DAC
776
ADC
768
ADC/DAC Clk
736
SW
BW=1.5MHz
280
SAW
BPF
744
748
SW
740
752
756
LO2-B
281.25 MHz
LPF
760
SW
764
770
778
DAC
772
780
ADC
ADC/DAC Clk

FIG. 81

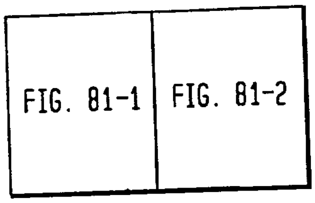


FIG. 81-1

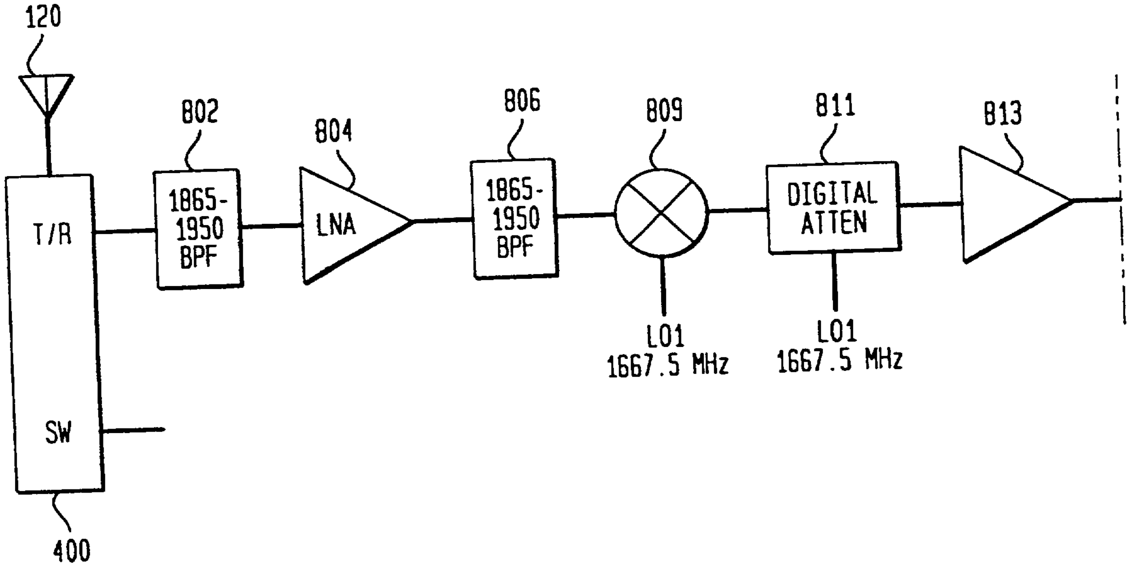


FIG. 81-2

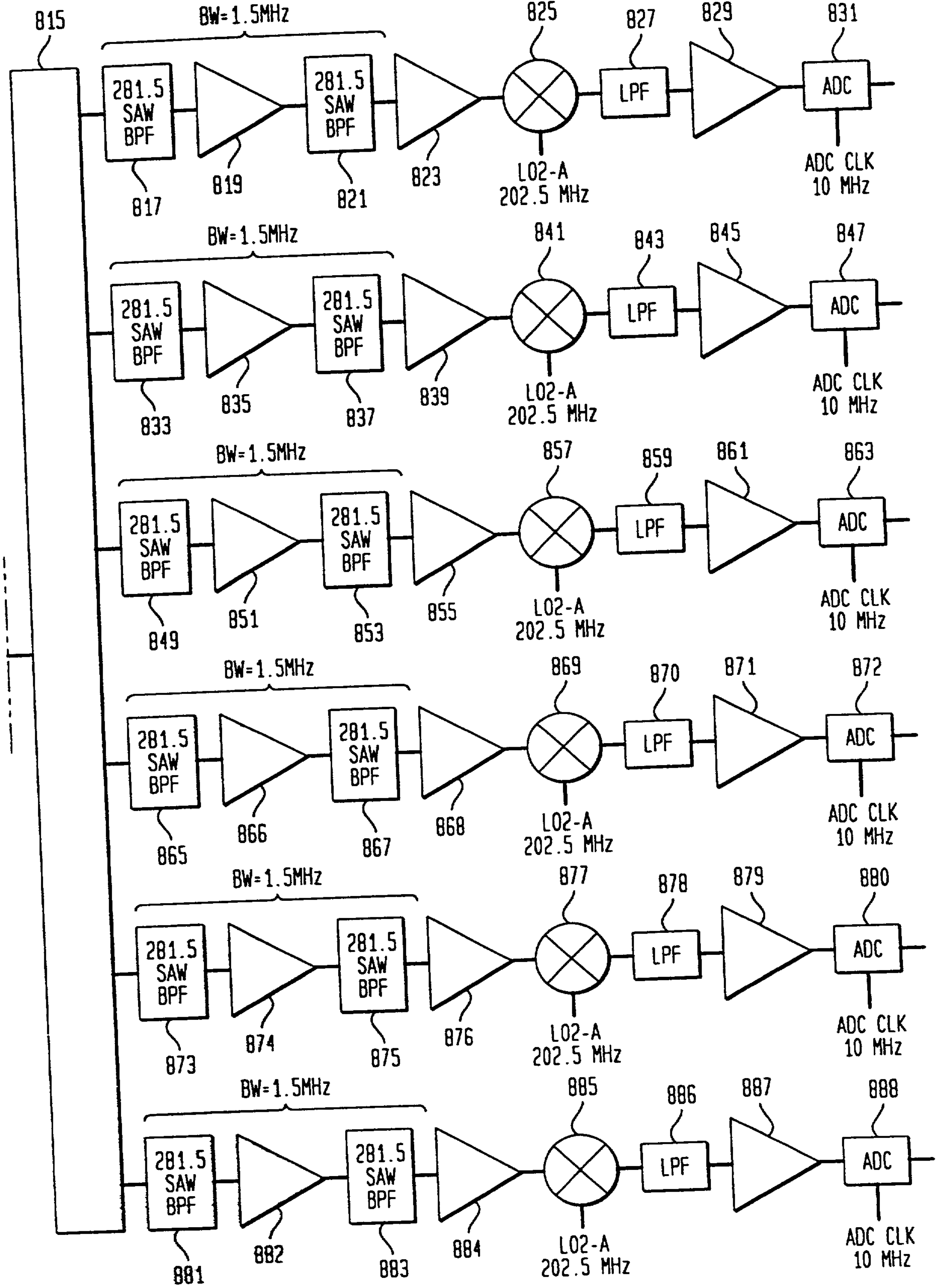

815
BW=1.5MHz
281.5 SAW BPF
817
819
281.5 SAW BPF
821
823
825
LO2-A 202.5 MHz
827
LPF
829
831
ADC
ADC CLK 10 MHz
BW=1.5MHz
281.5 SAW BPF
833
835
281.5 SAW BPF
837
839
841
LO2-A 202.5 MHz
843
LPF
845
847
ADC
ADC CLK 10 MHz
BW=1.5MHz
281.5 SAW BPF
849
851
281.5 SAW BPF
853
855
857
LO2-A 202.5 MHz
859
LPF
861
863
ADC
ADC CLK 10 MHz
BW=1.5MHz
281.5 SAW BPF
865
866
281.5 SAW BPF
867
868
869
LO2-A 202.5 MHz
870
LPF
871
872
ADC
ADC CLK 10 MHz
BW=1.5MHz
281.5 SAW BPF
873
874
281.5 SAW BPF
875
876
877
LO2-A 202.5 MHz
878
LPF
879
880
ADC
ADC CLK 10 MHz
BW=1.5MHz
281.5 SAW BPF
881
882
281.5 SAW BPF
883
884
885
LO2-A 202.5 MHz
886
LPF
887
888
ADC
ADC CLK 10 MHz

FIG. 81A

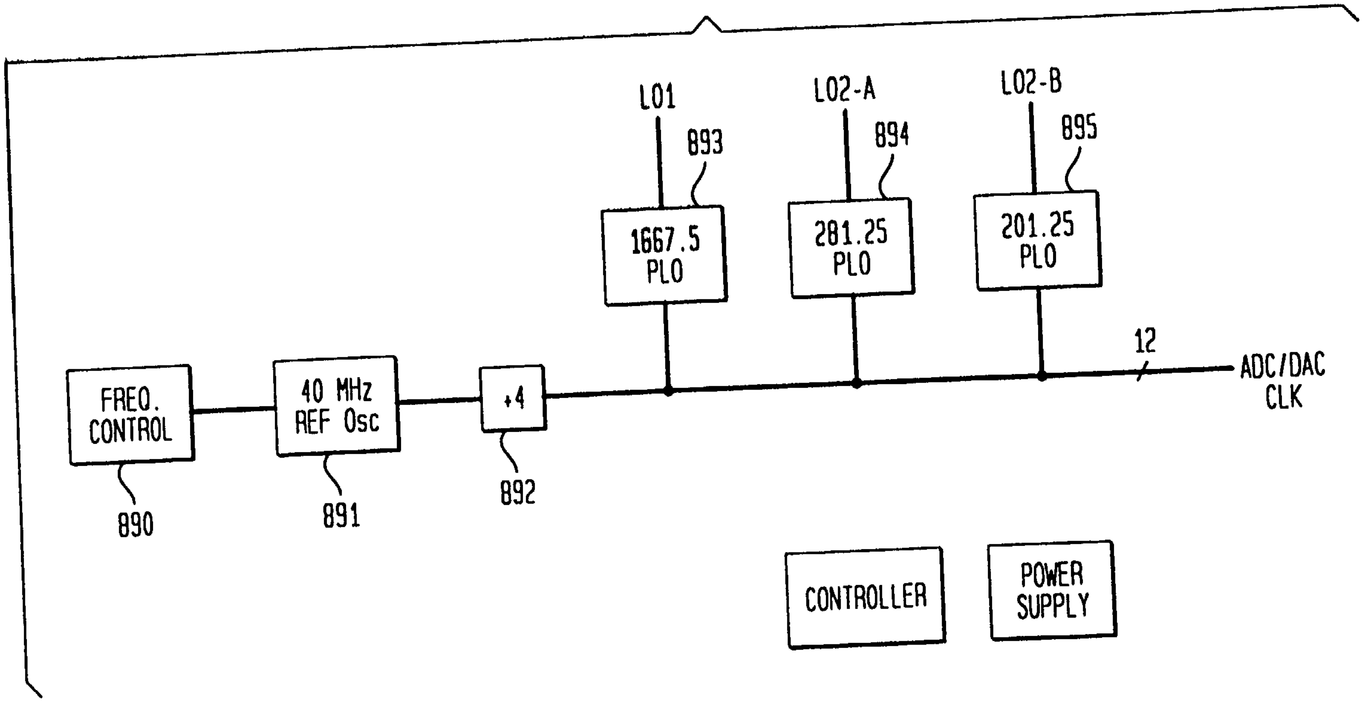

L01
893
1667.5
PLO
L02-A
894
281.25
PLO
L02-B
895
201.25
PLO
FREQ.
CONTROL
890
40 MHz
REF Osc
891
÷4
892
12
ADC/DAC
CLK
CONTROLLER
POWER
SUPPLY

FIG. 82

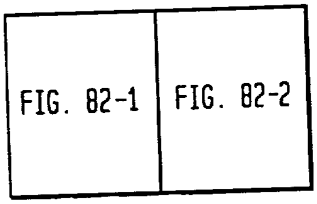


FIG. 82-1

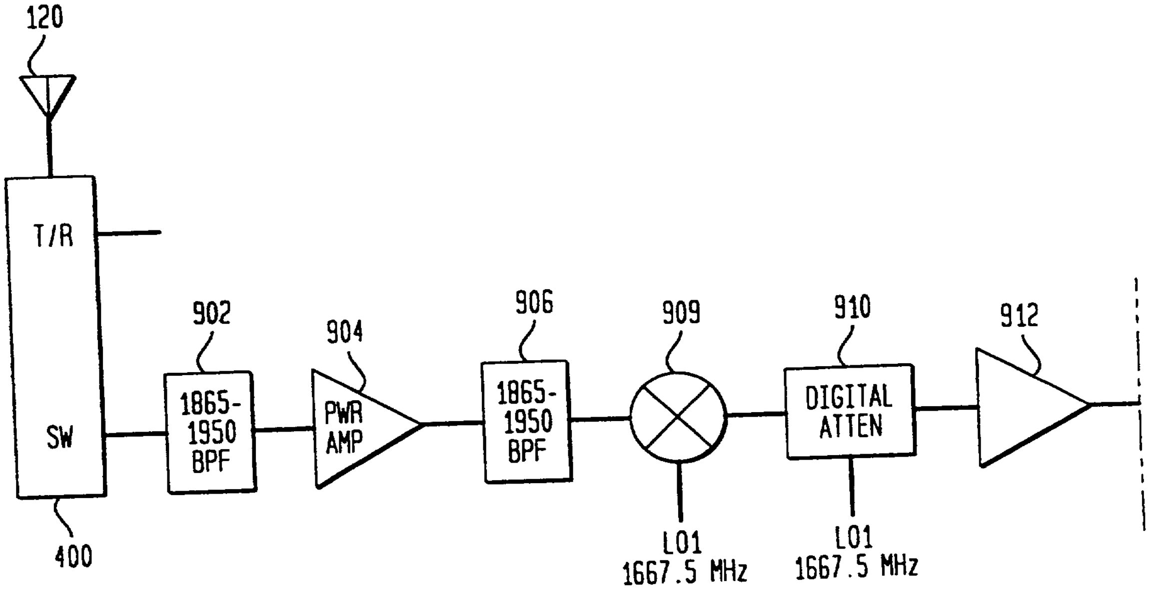


FIG. 82-2

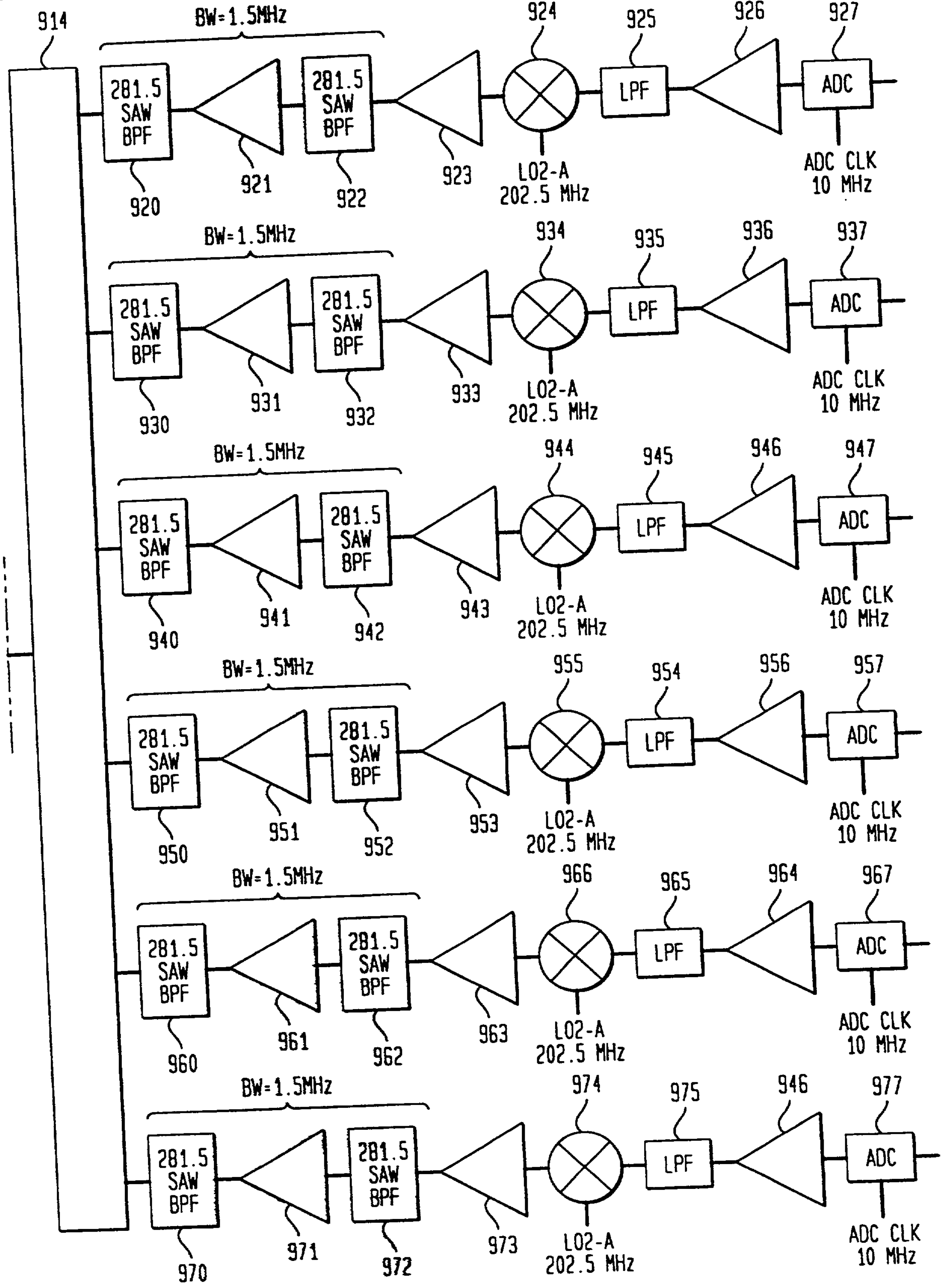

914
BW=1.5MHz
281.5 SAW BPF
920
921
281.5 SAW BPF
922
923
924
LO2-A 202.5 MHz
925
LPF
926
927
ADC
ADC CLK 10 MHz
BW=1.5MHz
281.5 SAW BPF
930
931
281.5 SAW BPF
932
933
934
LO2-A 202.5 MHz
935
LPF
936
937
ADC
ADC CLK 10 MHz
BW=1.5MHz
281.5 SAW BPF
940
941
281.5 SAW BPF
942
943
944
LO2-A 202.5 MHz
945
LPF
946
947
ADC
ADC CLK 10 MHz
BW=1.5MHz
281.5 SAW BPF
950
951
281.5 SAW BPF
952
953
955
LO2-A 202.5 MHz
954
LPF
956
957
ADC
ADC CLK 10 MHz
BW=1.5MHz
281.5 SAW BPF
960
961
281.5 SAW BPF
962
963
966
LO2-A 202.5 MHz
965
LPF
964
967
ADC
ADC CLK 10 MHz
BW=1.5MHz
281.5 SAW BPF
970
971
281.5 SAW BPF
972
973
974
LO2-A 202.5 MHz
975
LPF
946
977
ADC
ADC CLK 10 MHz

FIG. 83

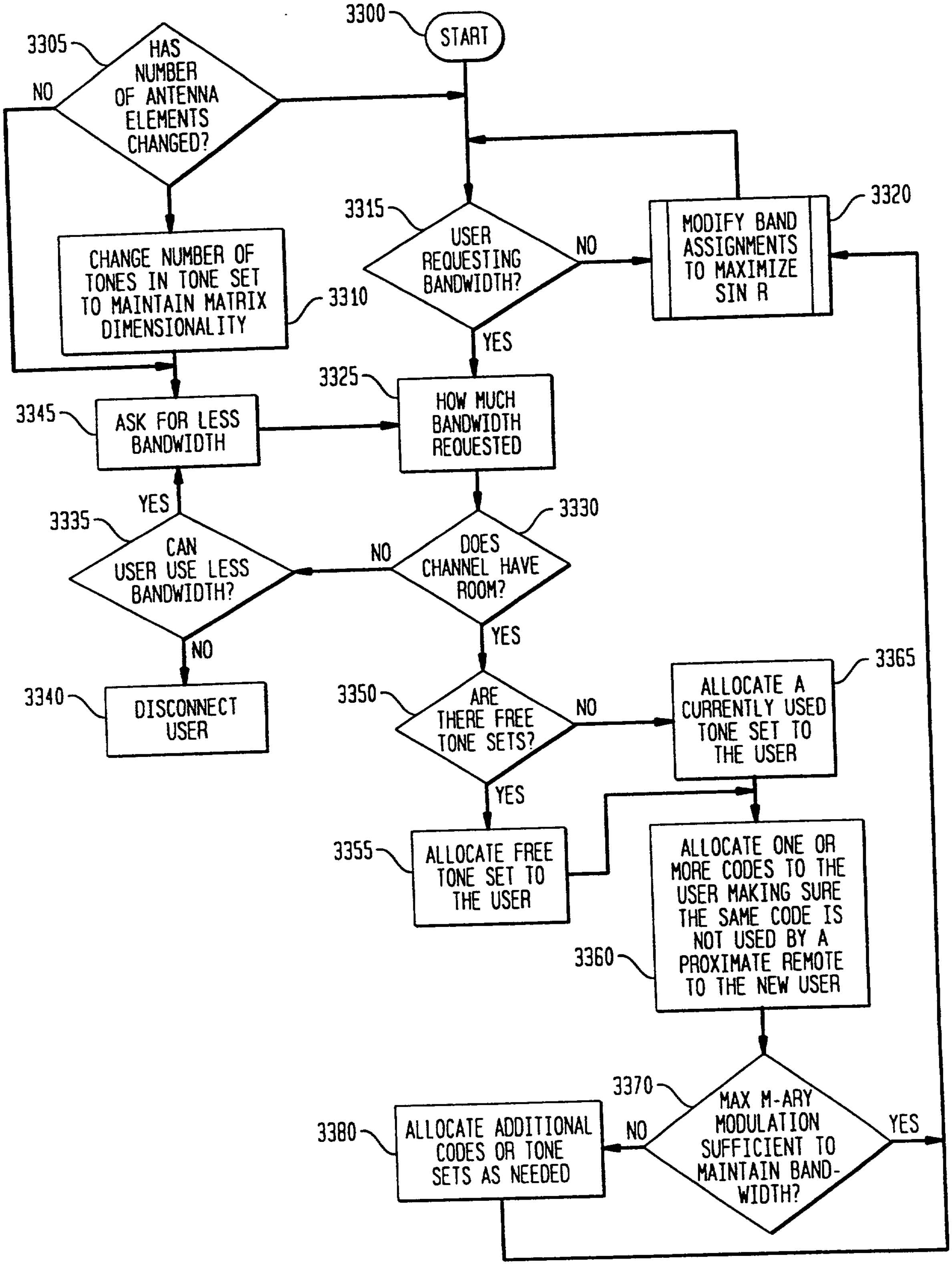

3300
START
3305
HAS NUMBER OF ANTENNA ELEMENTS CHANGED?
NO
3310
CHANGE NUMBER OF TONES IN TONE SET TO MAINTAIN MATRIX DIMENSIONALITY
3315
USER REQUESTING BANDWIDTH?
NO
YES
3320
MODIFY BAND ASSIGNMENTS TO MAXIMIZE SIN R
3325
HOW MUCH BANDWIDTH REQUESTED
3345
ASK FOR LESS BANDWIDTH
3335
CAN USER USE LESS BANDWIDTH?
YES
NO
3330
DOES CHANNEL HAVE ROOM?
NO
YES
3340
DISCONNECT USER
3350
ARE THERE FREE TONE SETS?
NO
YES
3365
ALLOCATE A CURRENTLY USED TONE SET TO THE USER
3355
ALLOCATE FREE TONE SET TO THE USER
3360
ALLOCATE ONE OR MORE CODES TO THE USER MAKING SURE THE SAME CODE IS NOT USED BY A PROXIMATE REMOTE TO THE NEW USER
3370
MAX M-ARY MODULATION SUFFICIENT TO MAINTAIN BAND-WIDTH?
NO
YES
3380
ALLOCATE ADDITIONAL CODES OR TONE SETS AS NEEDED

FIG. 84A

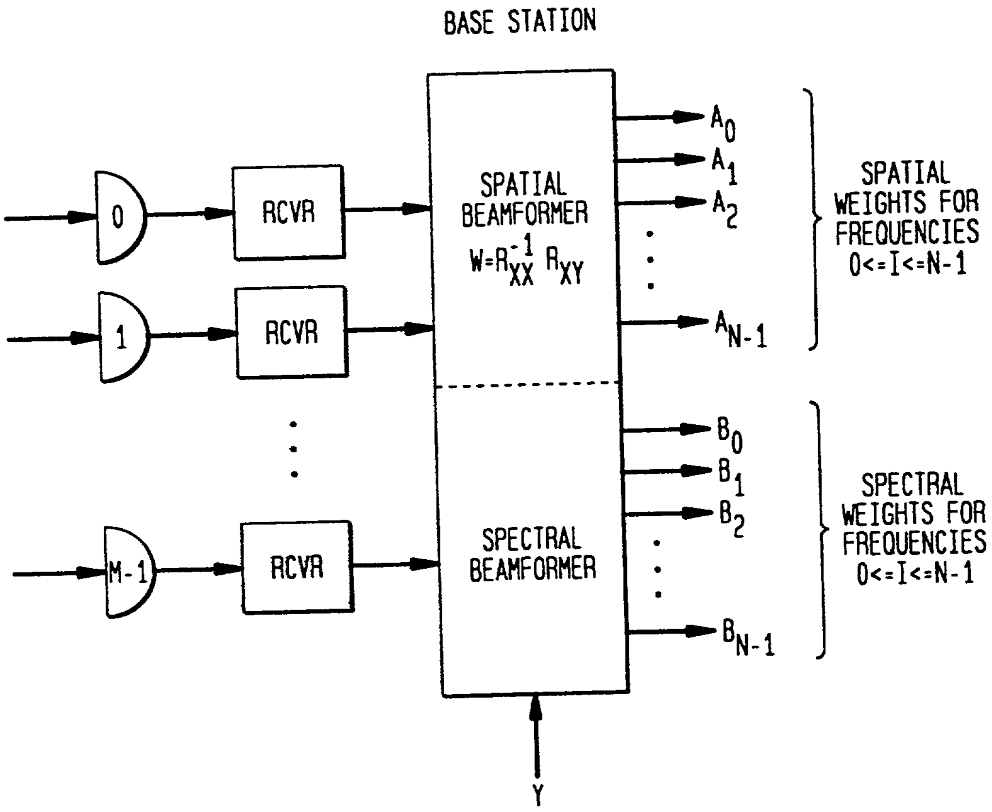

BASE STATION
0
1
M-1
RCVR
RCVR
RCVR
SPATIAL BEAMFORMER
W=R$_{XX}^{-1}$ R$_{XY}$
SPECTRAL BEAMFORMER
A_0
A_1
A_2
A_{N-1}
B_0
B_1
B_2
B_{N-1}
SPATIAL WEIGHTS FOR FREQUENCIES 0<=I<=N-1
SPECTRAL WEIGHTS FOR FREQUENCIES 0<=I<=N-1
Y

FIG. 84B

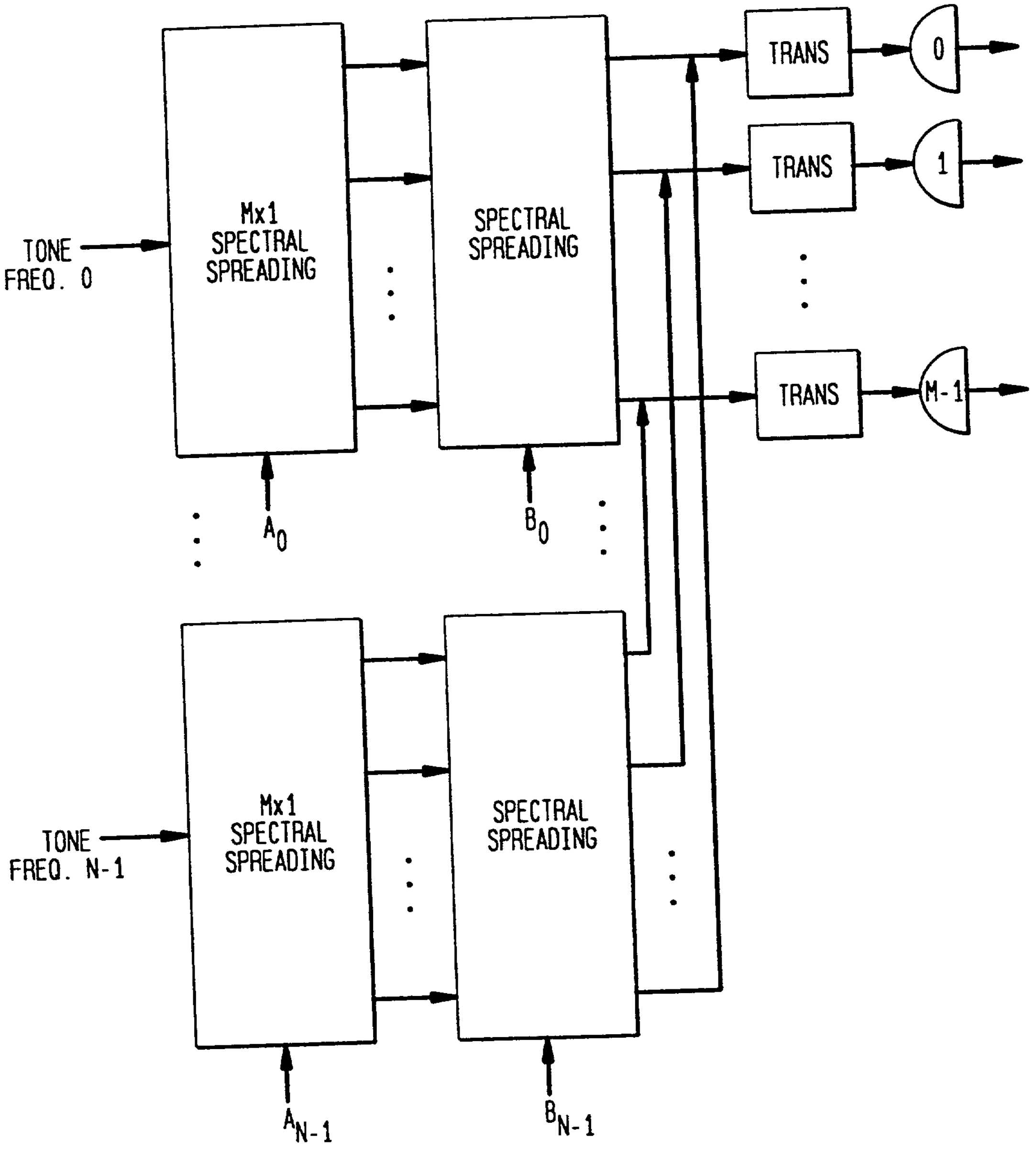

TONE FREQ. 0
Mx1 SPECTRAL SPREADING
SPECTRAL SPREADING
A_0
B_0
TRANS
TRANS
TRANS
0
1
M-1
TONE FREQ. N-1
Mx1 SPECTRAL SPREADING
SPECTRAL SPREADING
A_{N-1}
B_{N-1}

FIG. 85A1

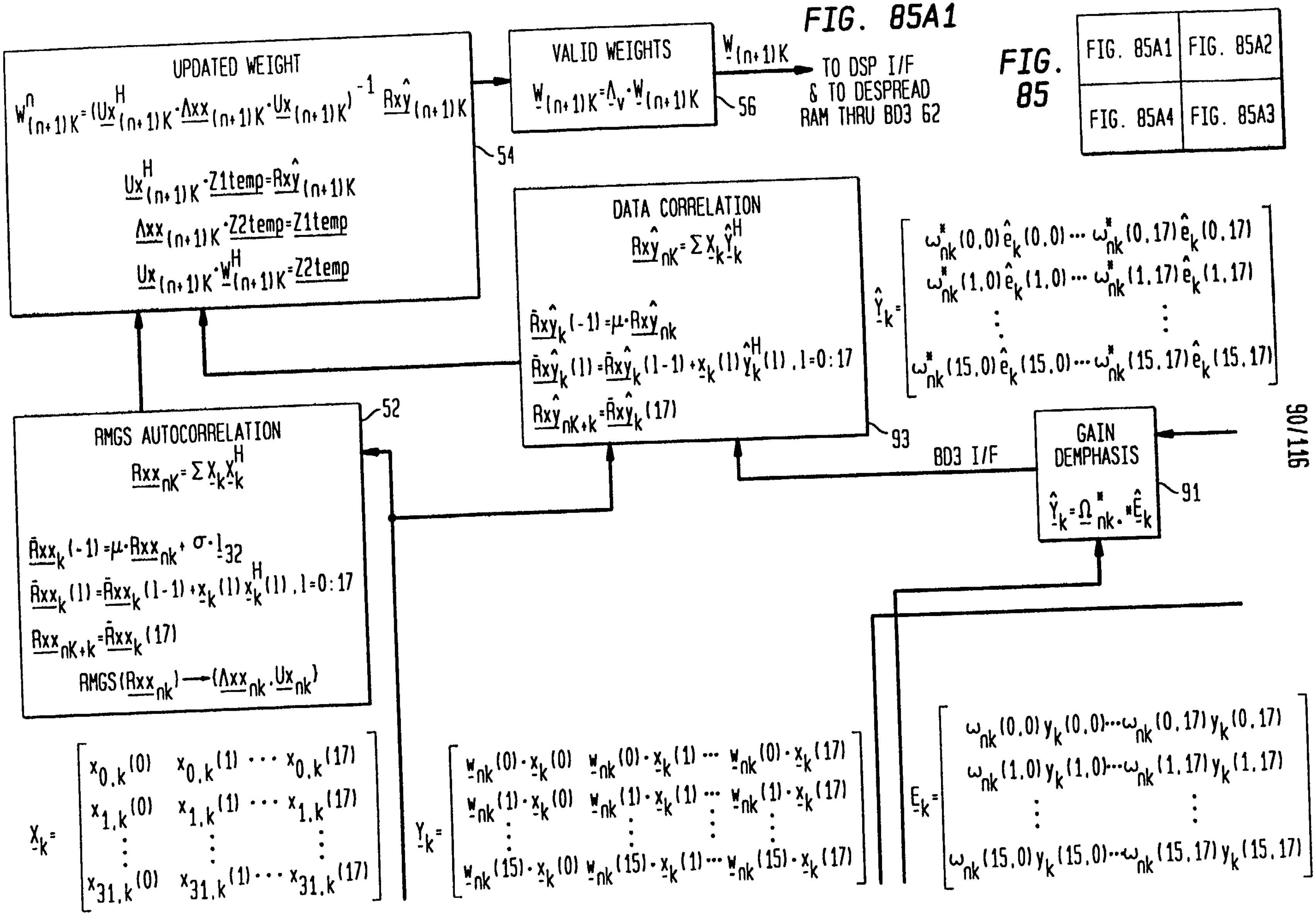


FIG. 85

FIG. 85A2

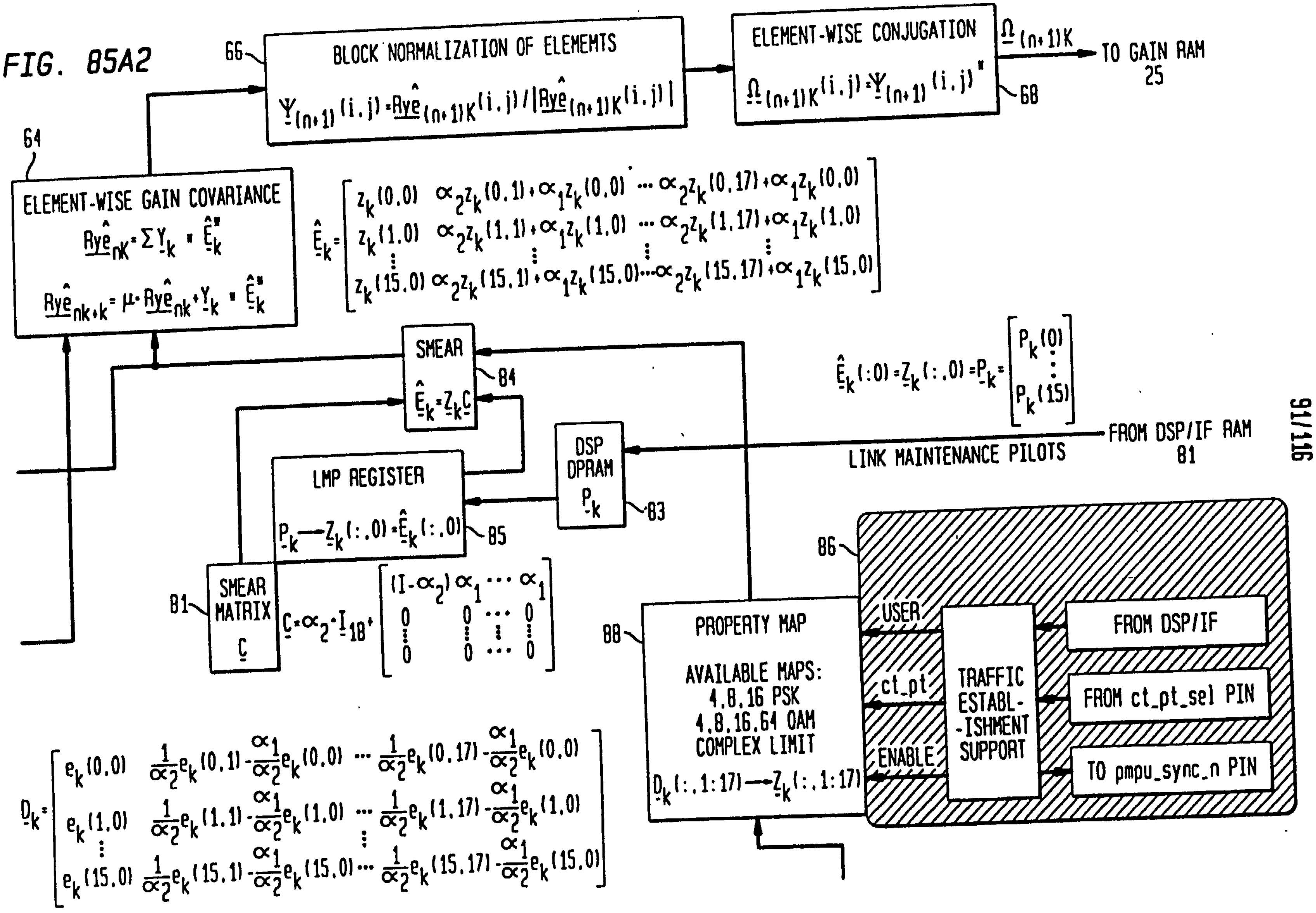

64
ELEMENT-WISE GAIN COVARIANCE
$\hat{Rye}_{nK} = \Sigma \underline{Y}_k * \hat{\underline{E}}_k^*$
$\hat{Rye}_{nk+k} = \mu \cdot \hat{Rye}_{nk} + \underline{Y}_k * \hat{\underline{E}}_k^*$
66
BLOCK NORMALIZATION OF ELEMENTS
$\underline{\Psi}_{(n+1)}(i,j) = \hat{Rye}_{(n+1)K}(i,j) / |\hat{Rye}_{(n+1)K}(i,j)|$
ELEMENT-WISE CONJUGATION
$\underline{\Omega}_{(n+1)K}(i,j) = \underline{\Psi}_{(n+1)}(i,j)^*$
68
$\underline{\Omega}_{(n+1)K}$
TO GAIN RAM
25
$\hat{\underline{E}}_k = \begin{bmatrix} z_k(0,0) & \alpha_2 z_k(0,1) + \alpha_1 z_k(0,0) & \cdots & \alpha_2 z_k(0,17) + \alpha_1 z_k(0,0) \\ z_k(1,0) & \alpha_2 z_k(1,1) + \alpha_1 z_k(1,0) & \cdots & \alpha_2 z_k(1,17) + \alpha_1 z_k(1,0) \\ \vdots & \vdots & & \vdots \\ z_k(15,0) & \alpha_2 z_k(15,1) + \alpha_1 z_k(15,0) & \cdots & \alpha_2 z_k(15,17) + \alpha_1 z_k(15,0) \end{bmatrix}$
SMEAR
$\hat{\underline{E}}_k = \underline{Z}_k \underline{C}$
84
$\hat{\underline{E}}_k(:0) = \underline{Z}_k(:,0) = \underline{P}_k = \begin{bmatrix} P_k(0) \\ \vdots \\ P_k(15) \end{bmatrix}$
FROM DSP/IF RAM
81
LINK MAINTENANCE PILOTS
DSP
DPRAM
$\underline{P}_k$
83
LMP REGISTER
$\underline{P}_k \rightarrow \underline{Z}_k(:,0) = \hat{\underline{E}}_k(:,0)$
85
81
SMEAR
MATRIX
$\underline{C}$
$\underline{C} = \alpha_2 \cdot \underline{I}_{18} + \begin{bmatrix} (1-\alpha_2) & \alpha_1 & \cdots & \alpha_1 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \vdots & \vdots \\ 0 & 0 & \cdots & 0 \end{bmatrix}$
86
88
PROPERTY MAP
AVAILABLE MAPS:
4,8,16 PSK
4,8,16,64 QAM
COMPLEX LIMIT
$\underline{D}_k(:,1:17) \rightarrow \underline{Z}_k(:,1:17)$
USER
ct_pt
ENABLE
TRAFFIC ESTABL-
-ISHMENT
SUPPORT
FROM DSP/IF
FROM ct_pt_sel PIN
TO pmpu_sync_n PIN
$\underline{D}_k = \begin{bmatrix} e_k(0,0) & \frac{1}{\alpha_2}e_k(0,1) - \frac{\alpha_1}{\alpha_2}e_k(0,0) & \cdots & \frac{1}{\alpha_2}e_k(0,17) - \frac{\alpha_1}{\alpha_2}e_k(0,0) \\ e_k(1,0) & \frac{1}{\alpha_2}e_k(1,1) - \frac{\alpha_1}{\alpha_2}e_k(1,0) & \cdots & \frac{1}{\alpha_2}e_k(1,17) - \frac{\alpha_1}{\alpha_2}e_k(1,0) \\ \vdots & & \vdots & \\ e_k(15,0) & \frac{1}{\alpha_2}e_k(15,1) - \frac{\alpha_1}{\alpha_2}e_k(15,0) & \cdots & \frac{1}{\alpha_2}e_k(15,17) - \frac{\alpha_1}{\alpha_2}e_k(15,0) \end{bmatrix}$

FIG. 85A3

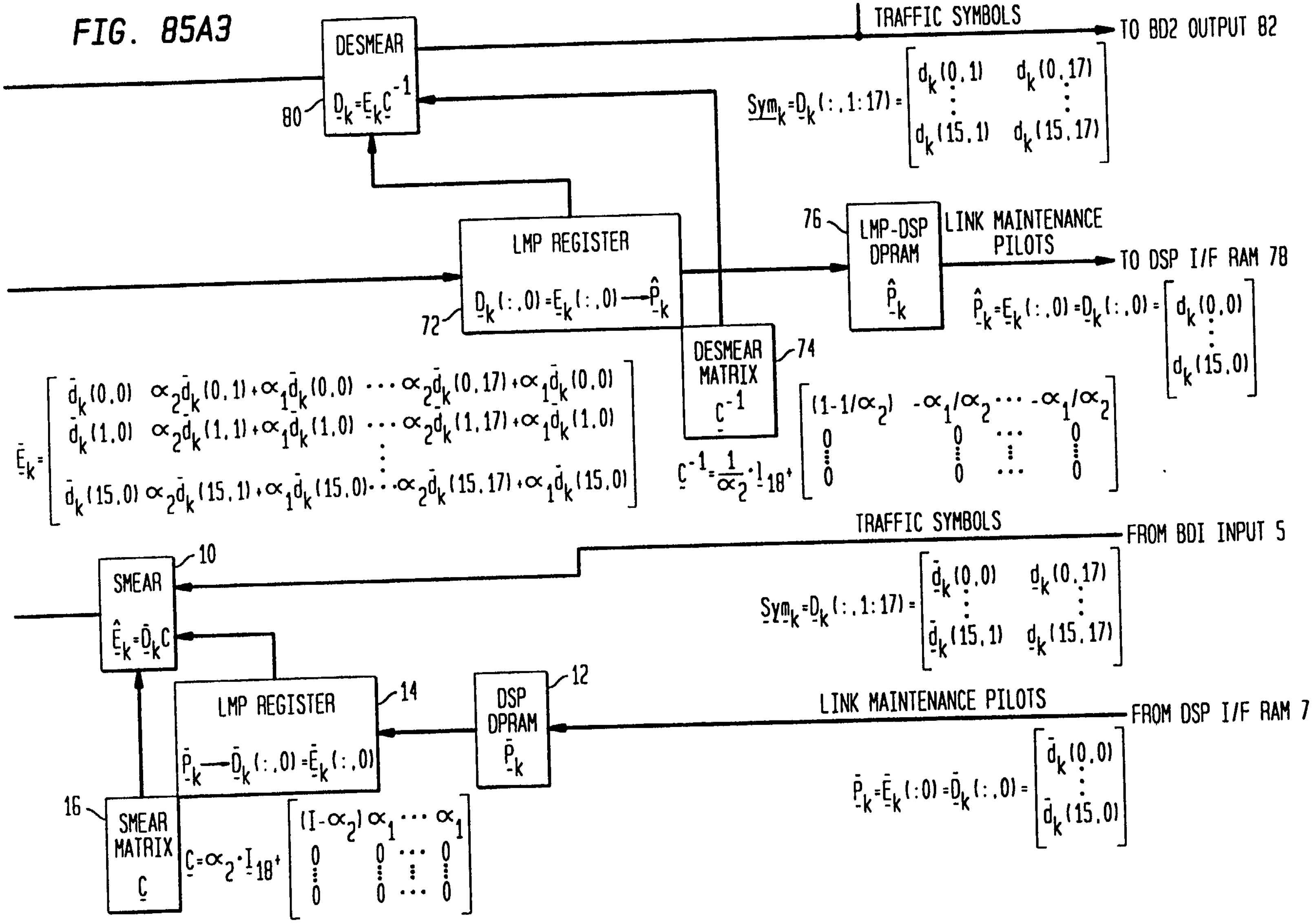

DESMEAR
$\underline{D}_k = \underline{E}_k \underline{C}^{-1}$
80
TRAFFIC SYMBOLS
TO BD2 OUTPUT 82
$\underline{Sym}_k = \underline{D}_k(:,1:17) = \begin{bmatrix} d_k(0,1) & d_k(0,17) \\ \vdots & \vdots \\ d_k(15,1) & d_k(15,17) \end{bmatrix}$
LMP REGISTER
$\underline{D}_k(:,0) = \underline{E}_k(:,0) \longrightarrow \hat{\underline{P}}_k$
72
76
LMP-DSP DPRAM
$\hat{\underline{P}}_k$
LINK MAINTENANCE PILOTS
TO DSP I/F RAM 78
$\hat{\underline{P}}_k = \underline{E}_k(:,0) = \underline{D}_k(:,0) = \begin{bmatrix} d_k(0,0) \\ \vdots \\ d_k(15,0) \end{bmatrix}$
DESMEAR MATRIX
$\underline{C}^{-1}$
74
$\bar{\underline{E}}_k = \begin{bmatrix} \bar{d}_k(0,0) & \alpha_2\bar{d}_k(0,1)+\alpha_1\bar{d}_k(0,0) & \cdots & \alpha_2\bar{d}_k(0,17)+\alpha_1\bar{d}_k(0,0) \\ \bar{d}_k(1,0) & \alpha_2\bar{d}_k(1,1)+\alpha_1\bar{d}_k(1,0) & \cdots & \alpha_2\bar{d}_k(1,17)+\alpha_1\bar{d}_k(1,0) \\ & & \vdots & \\ \bar{d}_k(15,0) & \alpha_2\bar{d}_k(15,1)+\alpha_1\bar{d}_k(15,0) & \cdots & \alpha_2\bar{d}_k(15,17)+\alpha_1\bar{d}_k(15,0) \end{bmatrix}$
$\underline{C}^{-1} = \frac{1}{\alpha_2} \cdot \underline{I}_{18} + \begin{bmatrix} (1-1/\alpha_2) & -\alpha_1/\alpha_2 & \cdots & -\alpha_1/\alpha_2 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \vdots & \vdots \\ 0 & 0 & \cdots & 0 \end{bmatrix}$
TRAFFIC SYMBOLS
FROM BDI INPUT 5
SMEAR
$\hat{\underline{E}}_k = \bar{\underline{D}}_k \underline{C}$
10
$\underline{Sym}_k = \underline{D}_k(:,1:17) = \begin{bmatrix} \bar{d}_k(0,0) & \underline{d}_k(0,17) \\ \vdots & \vdots \\ \bar{d}_k(15,1) & \underline{d}_k(15,17) \end{bmatrix}$
LMP REGISTER
$\bar{\underline{P}}_k \longrightarrow \bar{\underline{D}}_k(:,0) = \bar{\underline{E}}_k(:,0)$
14
DSP DPRAM
$\bar{\underline{P}}_k$
12
LINK MAINTENANCE PILOTS
FROM DSP I/F RAM 7
$\bar{\underline{P}}_k = \bar{\underline{E}}_k(:0) = \bar{\underline{D}}_k(:,0) = \begin{bmatrix} \bar{d}_k(0,0) \\ \vdots \\ \bar{d}_k(15,0) \end{bmatrix}$
16
SMEAR MATRIX
$\underline{C}$
$\underline{C} = \alpha_2 \cdot \underline{I}_{18} + \begin{bmatrix} (I-\alpha_2) & \alpha_1 & \cdots & \alpha_1 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \vdots & \vdots \\ 0 & 0 & \cdots & 0 \end{bmatrix}$

FIG. 85A4

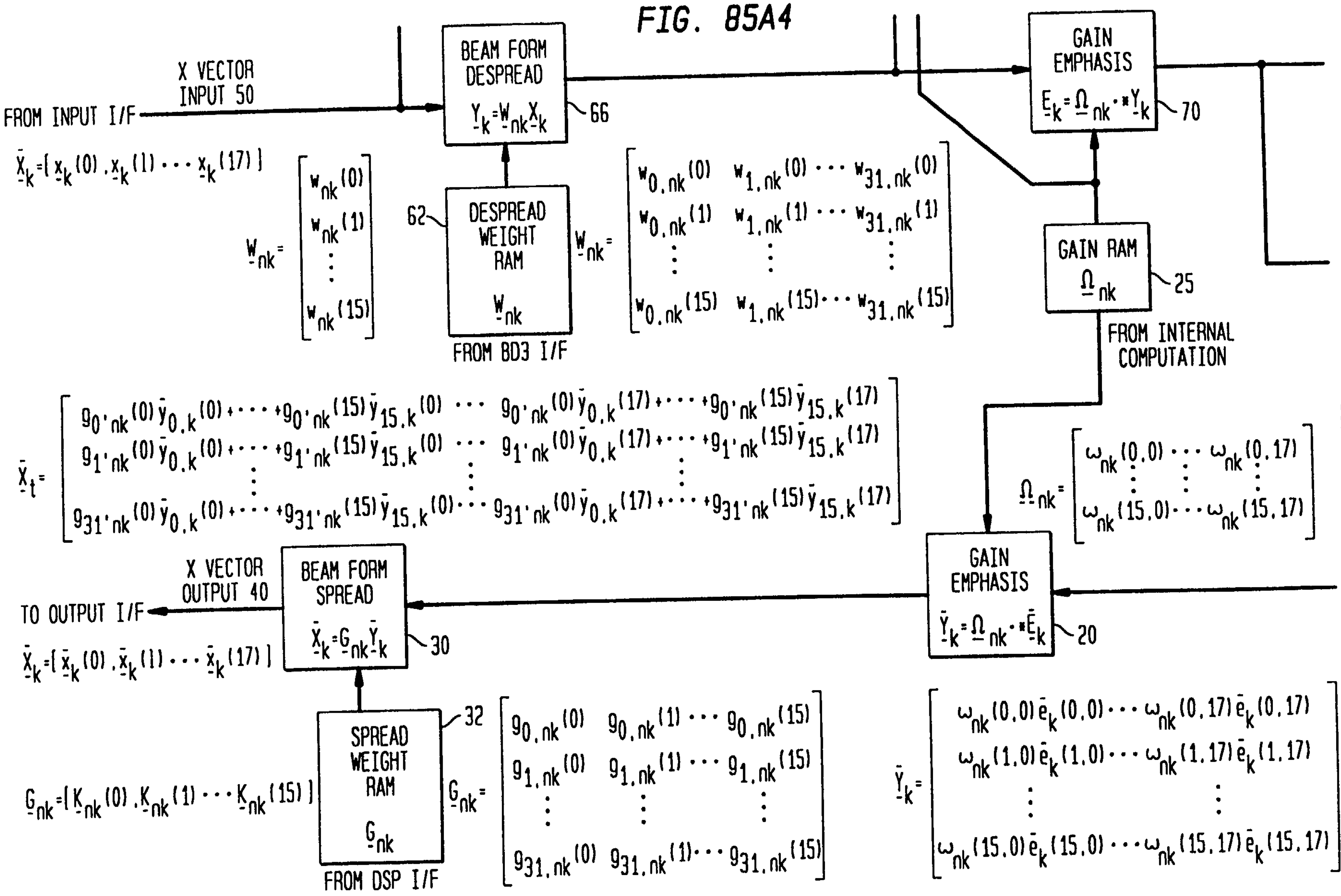

FROM INPUT I/F
X VECTOR INPUT 50
$\bar{X}_k = [x_k(0), x_k(1) \cdots x_k(17)]$
BEAM FORM DESPREAD
$Y_k = W_{nk} X_k$
66
62
DESPREAD WEIGHT RAM
W_{nk}
FROM BD3 I/F
$W_{nk} = \begin{bmatrix} w_{nk}(0) \\ w_{nk}(1) \\ \vdots \\ w_{nk}(15) \end{bmatrix}$
$W_{nk} = \begin{bmatrix} w_{0,nk}(0) & w_{1,nk}(0) \cdots & w_{31,nk}(0) \\ w_{0,nk}(1) & w_{1,nk}(1) \cdots & w_{31,nk}(1) \\ \vdots & \vdots & \vdots \\ w_{0,nk}(15) & w_{1,nk}(15) \cdots & w_{31,nk}(15) \end{bmatrix}$
GAIN EMPHASIS
$E_k = \Omega_{nk} \cdot * Y_k$
70
GAIN RAM
Ω_{nk}
25
FROM INTERNAL COMPUTATION
$\bar{X}_t = \begin{bmatrix} g_{0'nk}(0)\bar{y}_{0,k}(0) + \cdots + g_{0'nk}(15)\bar{y}_{15,k}(0) & \cdots & g_{0'nk}(0)\bar{y}_{0,k}(17) + \cdots + g_{0'nk}(15)\bar{y}_{15,k}(17) \\ g_{1'nk}(0)\bar{y}_{0,k}(0) + \cdots + g_{1'nk}(15)\bar{y}_{15,k}(0) & \cdots & g_{1'nk}(0)\bar{y}_{0,k}(17) + \cdots + g_{1'nk}(15)\bar{y}_{15,k}(17) \\ \vdots & \vdots & \vdots \\ g_{31'nk}(0)\bar{y}_{0,k}(0) + \cdots + g_{31'nk}(15)\bar{y}_{15,k}(0) & \cdots & g_{31'nk}(0)\bar{y}_{0,k}(17) + \cdots + g_{31'nk}(15)\bar{y}_{15,k}(17) \end{bmatrix}$
$\Omega_{nk} = \begin{bmatrix} \omega_{nk}(0,0) \cdots \omega_{nk}(0,17) \\ \vdots \qquad \vdots \\ \omega_{nk}(15,0) \cdots \omega_{nk}(15,17) \end{bmatrix}$
TO OUTPUT I/F
X VECTOR OUTPUT 40
$\bar{X}_k = [\bar{x}_k(0), \bar{x}_k(1) \cdots \bar{x}_k(17)]$
BEAM FORM SPREAD
$\bar{X}_k = G_{nk} \bar{Y}_k$
30
GAIN EMPHASIS
$\bar{Y}_k = \Omega_{nk} \cdot * \bar{E}_k$
20
32
SPREAD WEIGHT RAM
G_{nk}
FROM DSP I/F
$G_{nk} = [K_{nk}(0), K_{nk}(1) \cdots K_{nk}(15)]$
$G_{nk} = \begin{bmatrix} g_{0,nk}(0) & g_{0,nk}(1) \cdots & g_{0,nk}(15) \\ g_{1,nk}(0) & g_{1,nk}(1) \cdots & g_{1,nk}(15) \\ \vdots & \vdots & \vdots \\ g_{31,nk}(0) & g_{31,nk}(1) \cdots & g_{31,nk}(15) \end{bmatrix}$
$\bar{Y}_k = \begin{bmatrix} \omega_{nk}(0,0)\bar{e}_k(0,0) \cdots \omega_{nk}(0,17)\bar{e}_k(0,17) \\ \omega_{nk}(1,0)\bar{e}_k(1,0) \cdots \omega_{nk}(1,17)\bar{e}_k(1,17) \\ \vdots \qquad \vdots \\ \omega_{nk}(15,0)\bar{e}_k(15,0) \cdots \omega_{nk}(15,17)\bar{e}_k(15,17) \end{bmatrix}$

FIG. 85B1

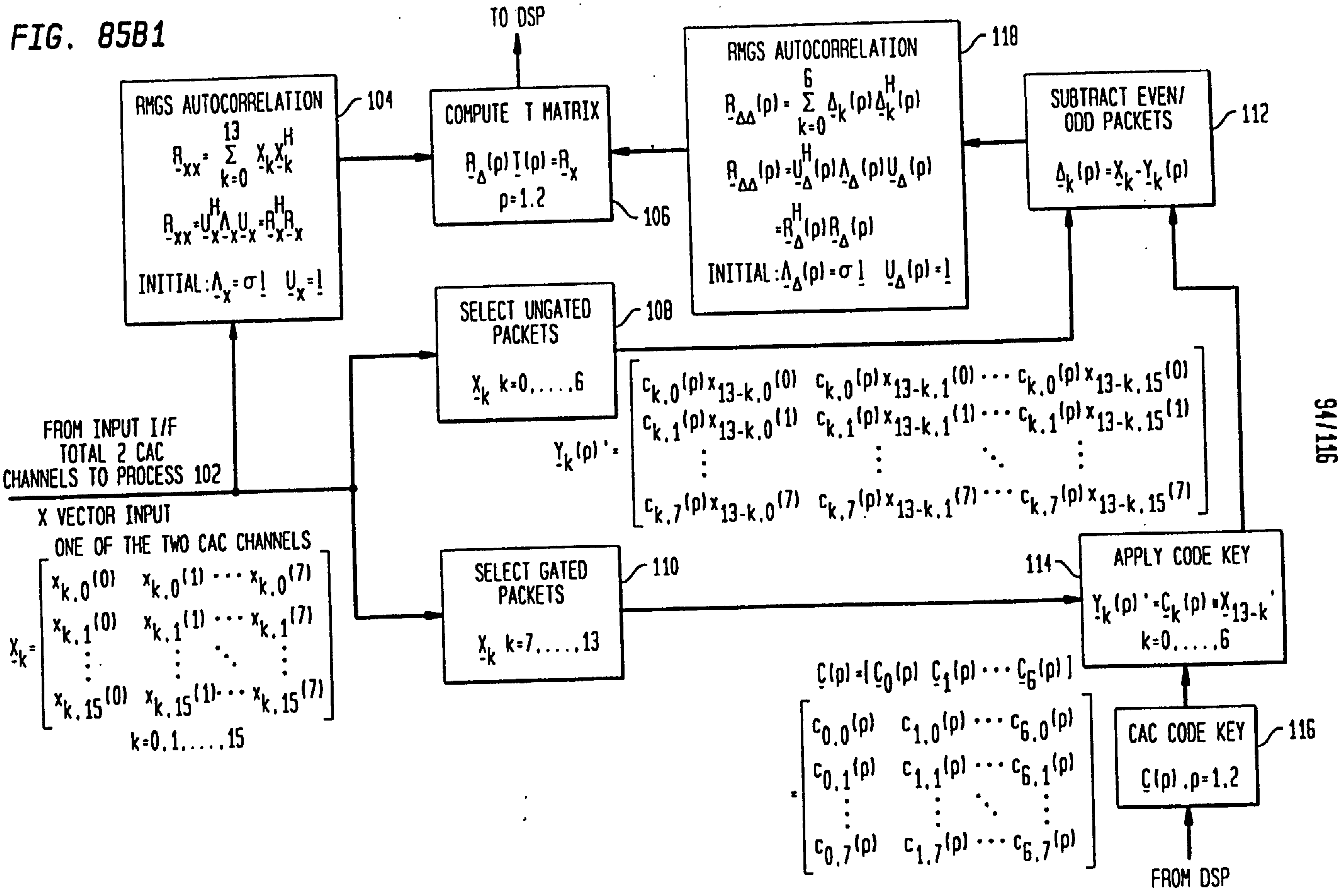

RMGS AUTOCORRELATION
$\underline{R}_{xx} = \sum_{k=0}^{13} \underline{X}_k \underline{X}_k^H$
$\underline{R}_{xx} = \underline{U}_x^H \underline{\Lambda}_x \underline{U}_x = \underline{R}_x^H \underline{R}_x$
INITIAL: $\underline{\Lambda}_x = \sigma \underline{I}$ $\underline{U}_x = \underline{I}$
104
TO DSP
COMPUTE T MATRIX
$\underline{R}_\Delta(p) \underline{T}(p) = \underline{R}_x$
p=1.2
106
RMGS AUTOCORRELATION
$\underline{R}_{\Delta\Delta}(p) = \sum_{k=0}^{6} \underline{\Delta}_k(p) \underline{\Delta}_k^H(p)$
$\underline{R}_{\Delta\Delta}(p) = \underline{U}_\Delta^H(p) \underline{\Lambda}_\Delta(p) \underline{U}_\Delta(p)$
$= \underline{R}_\Delta^H(p) \underline{R}_\Delta(p)$
INITIAL: $\underline{\Lambda}_\Delta(p) = \sigma \underline{I}$ $\underline{U}_\Delta(p) = \underline{I}$
118
SUBTRACT EVEN/ ODD PACKETS
$\underline{\Delta}_k(p) = \underline{X}_k - \underline{Y}_k(p)$
112
FROM INPUT I/F TOTAL 2 CAC CHANNELS TO PROCESS 102
X VECTOR INPUT
ONE OF THE TWO CAC CHANNELS
$\underline{X}_k = \begin{bmatrix} x_{k,0}^{(0)} & x_{k,0}^{(1)} & \cdots & x_{k,0}^{(7)} \\ x_{k,1}^{(0)} & x_{k,1}^{(1)} & \cdots & x_{k,1}^{(7)} \\ \vdots & \vdots & \ddots & \vdots \\ x_{k,15}^{(0)} & x_{k,15}^{(1)} & \cdots & x_{k,15}^{(7)} \end{bmatrix}$
k=0.1.....15
SELECT UNGATED PACKETS
$\underline{X}_k$ k=0.....6
108
$\underline{Y}_k(p)' = \begin{bmatrix} c_{k,0}(p)x_{13-k,0}^{(0)} & c_{k,0}(p)x_{13-k,1}^{(0)} & \cdots & c_{k,0}(p)x_{13-k,15}^{(0)} \\ c_{k,1}(p)x_{13-k,0}^{(1)} & c_{k,1}(p)x_{13-k,1}^{(1)} & \cdots & c_{k,1}(p)x_{13-k,15}^{(1)} \\ \vdots & \vdots & \ddots & \vdots \\ c_{k,7}(p)x_{13-k,0}^{(7)} & c_{k,7}(p)x_{13-k,1}^{(7)} & \cdots & c_{k,7}(p)x_{13-k,15}^{(7)} \end{bmatrix}$
SELECT GATED PACKETS
$\underline{X}_k$ k=7.....13
110
114
APPLY CODE KEY
$\underline{Y}_k(p)' = \underline{C}_k(p) * \underline{X}_{13-k}'$
k=0.....6
$\underline{C}(p) = [\underline{C}_0(p)\ \underline{C}_1(p) \cdots \underline{C}_6(p)]$
$= \begin{bmatrix} c_{0,0}(p) & c_{1,0}(p) & \cdots & c_{6,0}(p) \\ c_{0,1}(p) & c_{1,1}(p) & \cdots & c_{6,1}(p) \\ \vdots & \vdots & \ddots & \vdots \\ c_{0,7}(p) & c_{1,7}(p) & \cdots & c_{6,7}(p) \end{bmatrix}$
CAC CODE KEY
$\underline{C}(p)$ .p=1.2
116
FROM DSP

FIG. 85B2

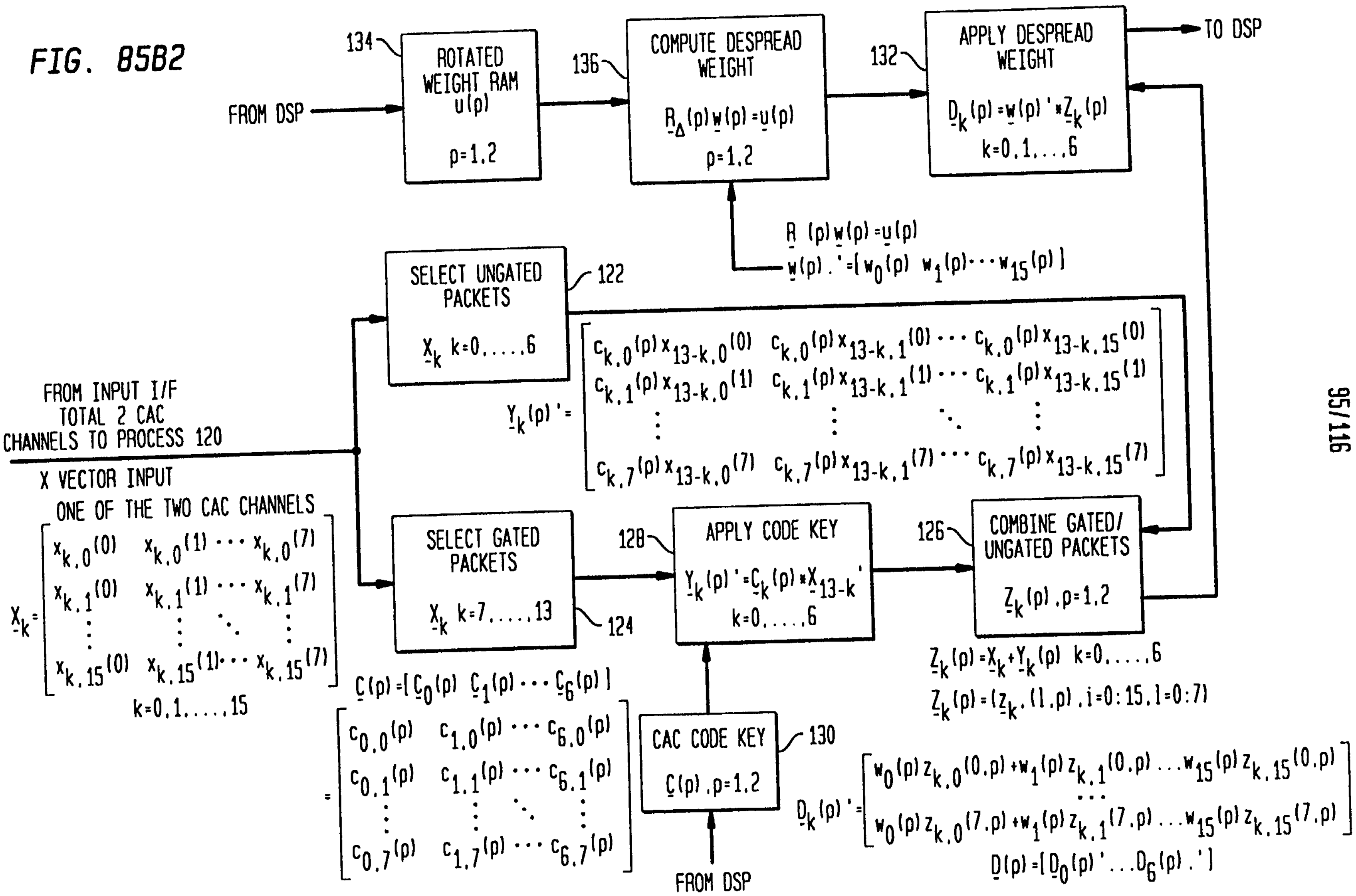

FROM DSP
134
ROTATED WEIGHT RAM $\underline{u}(p)$
$p=1,2$
136
COMPUTE DESPREAD WEIGHT
$\underline{R}_\Delta(p)\underline{w}(p)=\underline{u}(p)$
$p=1,2$
132
APPLY DESPREAD WEIGHT
$\underline{D}_k(p)=\underline{w}(p)'*\underline{Z}_k(p)$
$k=0,1,\ldots,6$
TO DSP
$\underline{R}(p)\underline{w}(p)=\underline{u}(p)$
$\underline{w}(p).'=[w_0(p)\ w_1(p)\cdots w_{15}(p)]$
FROM INPUT I/F
TOTAL 2 CAC
CHANNELS TO PROCESS 120
X VECTOR INPUT
ONE OF THE TWO CAC CHANNELS
$\underline{X}_k=\begin{bmatrix} x_{k,0}(0) & x_{k,0}(1) & \cdots & x_{k,0}(7) \\ x_{k,1}(0) & x_{k,1}(1) & \cdots & x_{k,1}(7) \\ \vdots & \vdots & \ddots & \vdots \\ x_{k,15}(0) & x_{k,15}(1) & \cdots & x_{k,15}(7) \end{bmatrix}$
$k=0,1,\ldots,15$
SELECT UNGATED PACKETS
$\underline{X}_k\ k=0,\ldots,6$
122
$\underline{Y}_k(p)'=\begin{bmatrix} c_{k,0}(p)x_{13-k,0}(0) & c_{k,0}(p)x_{13-k,1}(0) & \cdots & c_{k,0}(p)x_{13-k,15}(0) \\ c_{k,1}(p)x_{13-k,0}(1) & c_{k,1}(p)x_{13-k,1}(1) & \cdots & c_{k,1}(p)x_{13-k,15}(1) \\ \vdots & \vdots & \ddots & \vdots \\ c_{k,7}(p)x_{13-k,0}(7) & c_{k,7}(p)x_{13-k,1}(7) & \cdots & c_{k,7}(p)x_{13-k,15}(7) \end{bmatrix}$
SELECT GATED PACKETS
$\underline{X}_k\ k=7,\ldots,13$
124
128
APPLY CODE KEY
$\underline{Y}_k(p)'=\underline{C}_k(p)*\underline{X}_{13-k}'$
$k=0,\ldots,6$
126
COMBINE GATED/ UNGATED PACKETS
$\underline{Z}_k(p),p=1,2$
$\underline{C}(p)=[\underline{C}_0(p)\ \underline{C}_1(p)\cdots\underline{C}_6(p)]$
$=\begin{bmatrix} c_{0,0}(p) & c_{1,0}(p) & \cdots & c_{6,0}(p) \\ c_{0,1}(p) & c_{1,1}(p) & \cdots & c_{6,1}(p) \\ \vdots & \vdots & \ddots & \vdots \\ c_{0,7}(p) & c_{1,7}(p) & \cdots & c_{6,7}(p) \end{bmatrix}$
CAC CODE KEY
$\underline{C}(p),p=1,2$
130
FROM DSP
$\underline{Z}_k(p)=\underline{X}_k+\underline{Y}_k(p)\ k=0,\ldots,6$
$\underline{Z}_k(p)=(z_k,(l,p),i=0:15,l=0:7)$
$\underline{D}_k(p)'=\begin{bmatrix} w_0(p)z_{k,0}(0,p)+w_1(p)z_{k,1}(0,p)\ldots w_{15}(p)z_{k,15}(0,p) \\ \cdots \\ w_0(p)z_{k,0}(7,p)+w_1(p)z_{k,1}(7,p)\ldots w_{15}(p)z_{k,15}(7,p) \end{bmatrix}$
$\underline{D}(p)=[\underline{D}_0(p)'\ldots\underline{D}_6(p).']$

FIG. 86

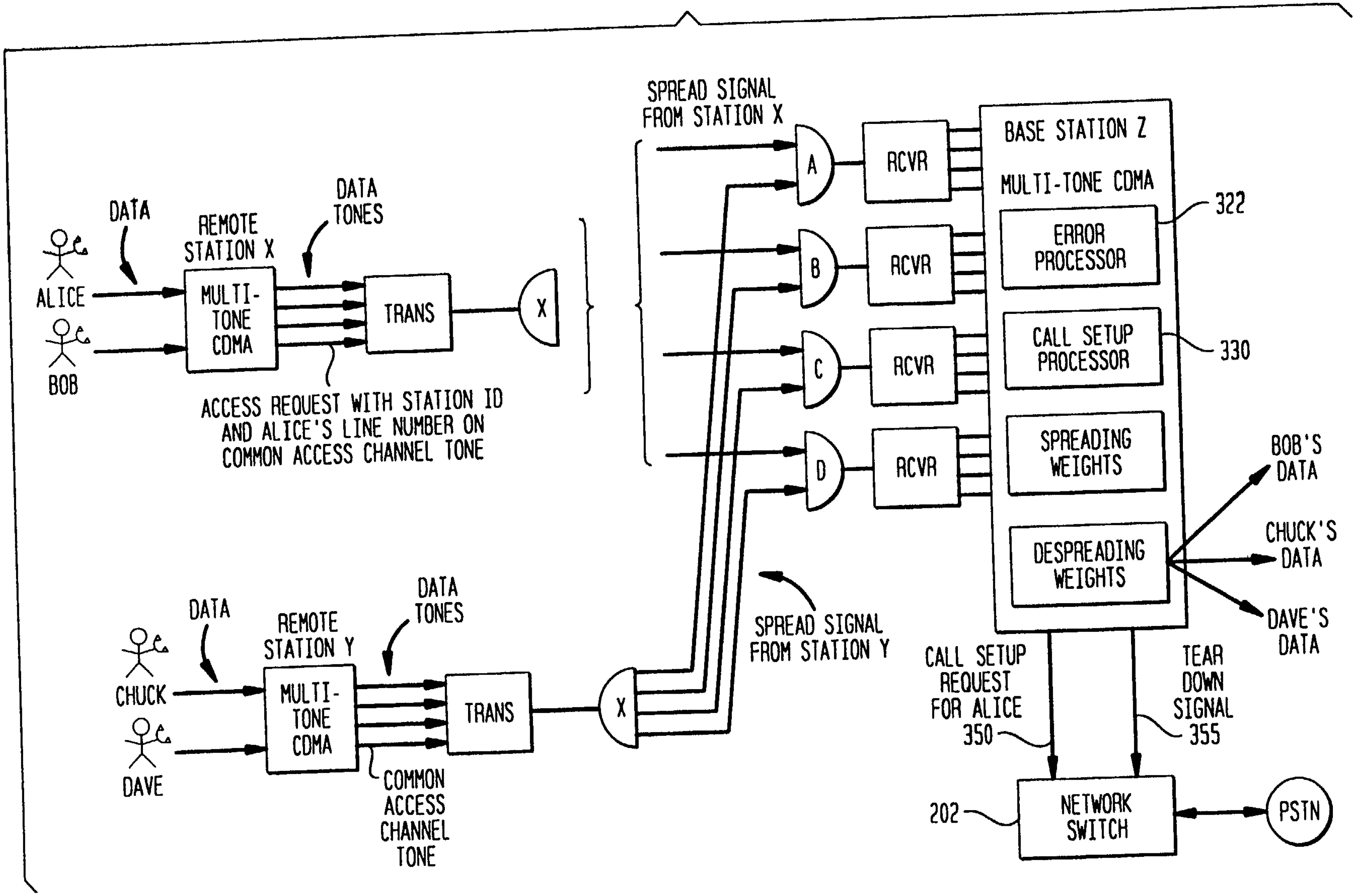

SPREAD SIGNAL FROM STATION X
DATA
REMOTE STATION X
DATA TONES
ALICE
MULTI-TONE CDMA
TRANS
X
BOB
ACCESS REQUEST WITH STATION ID AND ALICE'S LINE NUMBER ON COMMON ACCESS CHANNEL TONE
A
B
C
D
RCVR
RCVR
RCVR
RCVR
BASE STATION Z
MULTI-TONE CDMA
322
ERROR PROCESSOR
CALL SETUP PROCESSOR
330
SPREADING WEIGHTS
DESPREADING WEIGHTS
BOB'S DATA
CHUCK'S DATA
DAVE'S DATA
DATA
REMOTE STATION Y
DATA TONES
CHUCK
MULTI-TONE CDMA
TRANS
X
DAVE
COMMON ACCESS CHANNEL TONE
SPREAD SIGNAL FROM STATION Y
CALL SETUP REQUEST FOR ALICE 350
TEAR DOWN SIGNAL 355
202
NETWORK SWITCH
PSTN

FIG. 87

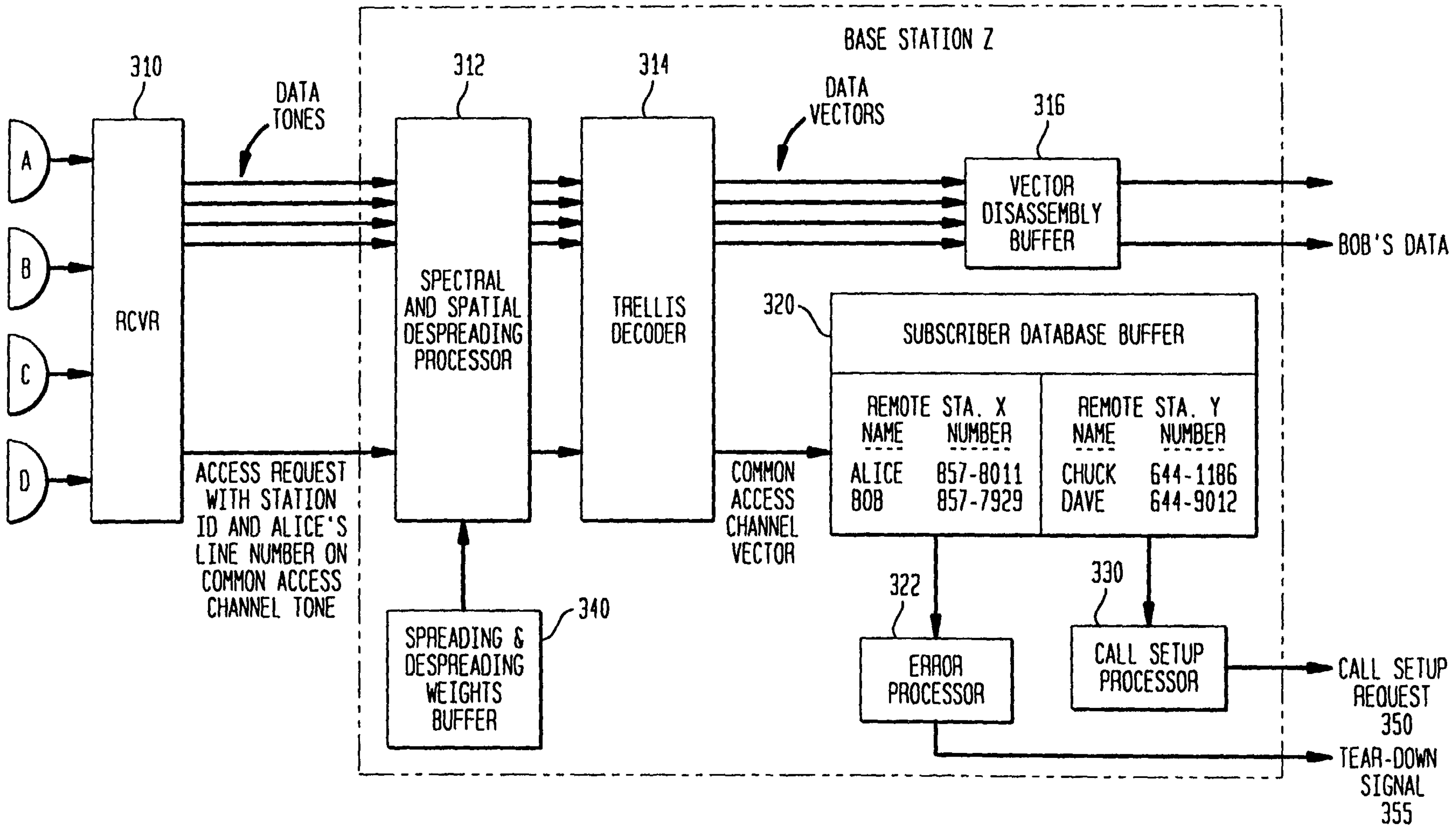

BASE STATION Z
A
B
C
D
310
RCVR
DATA TONES
ACCESS REQUEST WITH STATION ID AND ALICE'S LINE NUMBER ON COMMON ACCESS CHANNEL TONE
312
SPECTRAL AND SPATIAL DESPREADING PROCESSOR
340
SPREADING & DESPREADING WEIGHTS BUFFER
314
TRELLIS DECODER
DATA VECTORS
COMMON ACCESS CHANNEL VECTOR
316
VECTOR DISASSEMBLY BUFFER
BOB'S DATA
320
SUBSCRIBER DATABASE BUFFER
REMOTE STA. X
NAME NUMBER
ALICE 857-8011
BOB 857-7929
REMOTE STA. Y
NAME NUMBER
CHUCK 644-1186
DAVE 644-9012
322
ERROR PROCESSOR
330
CALL SETUP PROCESSOR
CALL SETUP REQUEST 350
TEAR-DOWN SIGNAL 355

FIG. 88

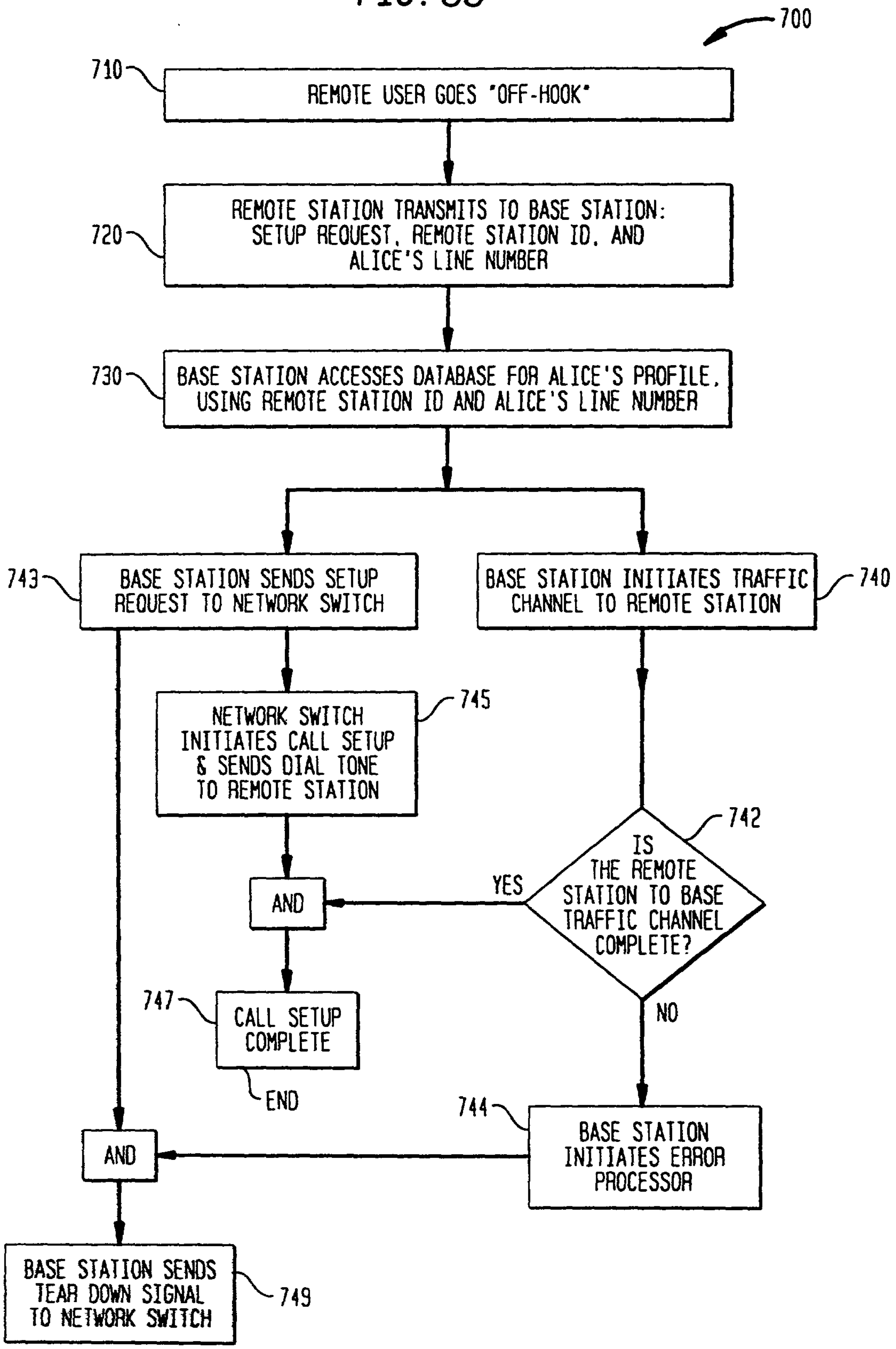

700
710
REMOTE USER GOES "OFF-HOOK"
720
REMOTE STATION TRANSMITS TO BASE STATION: SETUP REQUEST, REMOTE STATION ID, AND ALICE'S LINE NUMBER
730
BASE STATION ACCESSES DATABASE FOR ALICE'S PROFILE, USING REMOTE STATION ID AND ALICE'S LINE NUMBER
743
BASE STATION SENDS SETUP REQUEST TO NETWORK SWITCH
BASE STATION INITIATES TRAFFIC CHANNEL TO REMOTE STATION
740
NETWORK SWITCH INITIATES CALL SETUP & SENDS DIAL TONE TO REMOTE STATION
745
742
IS THE REMOTE STATION TO BASE TRAFFIC CHANNEL COMPLETE?
YES
AND
NO
747
CALL SETUP COMPLETE
END
744
BASE STATION INITIATES ERROR PROCESSOR
AND
BASE STATION SENDS TEAR DOWN SIGNAL TO NETWORK SWITCH
749

FIG. 89

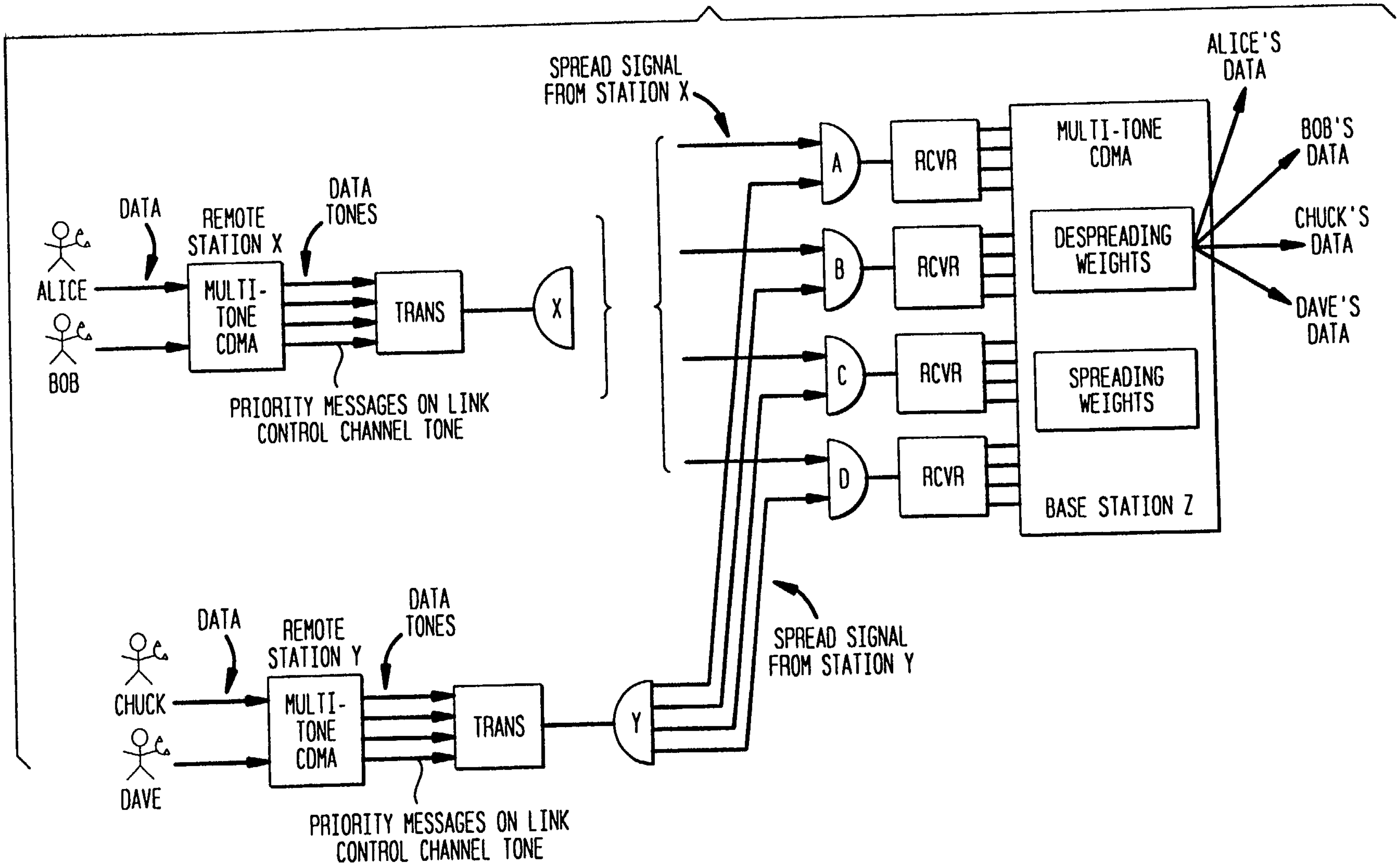

ALICE
BOB
DATA
REMOTE STATION X
MULTI-TONE CDMA
DATA TONES
TRANS
PRIORITY MESSAGES ON LINK CONTROL CHANNEL TONE
X
CHUCK
DAVE
DATA
REMOTE STATION Y
MULTI-TONE CDMA
DATA TONES
TRANS
PRIORITY MESSAGES ON LINK CONTROL CHANNEL TONE
Y
SPREAD SIGNAL FROM STATION X
SPREAD SIGNAL FROM STATION Y
A
B
C
D
RCVR
RCVR
RCVR
RCVR
MULTI-TONE CDMA
DESPREADING WEIGHTS
SPREADING WEIGHTS
BASE STATION Z
ALICE'S DATA
BOB'S DATA
CHUCK'S DATA
DAVE'S DATA

FIG. 90

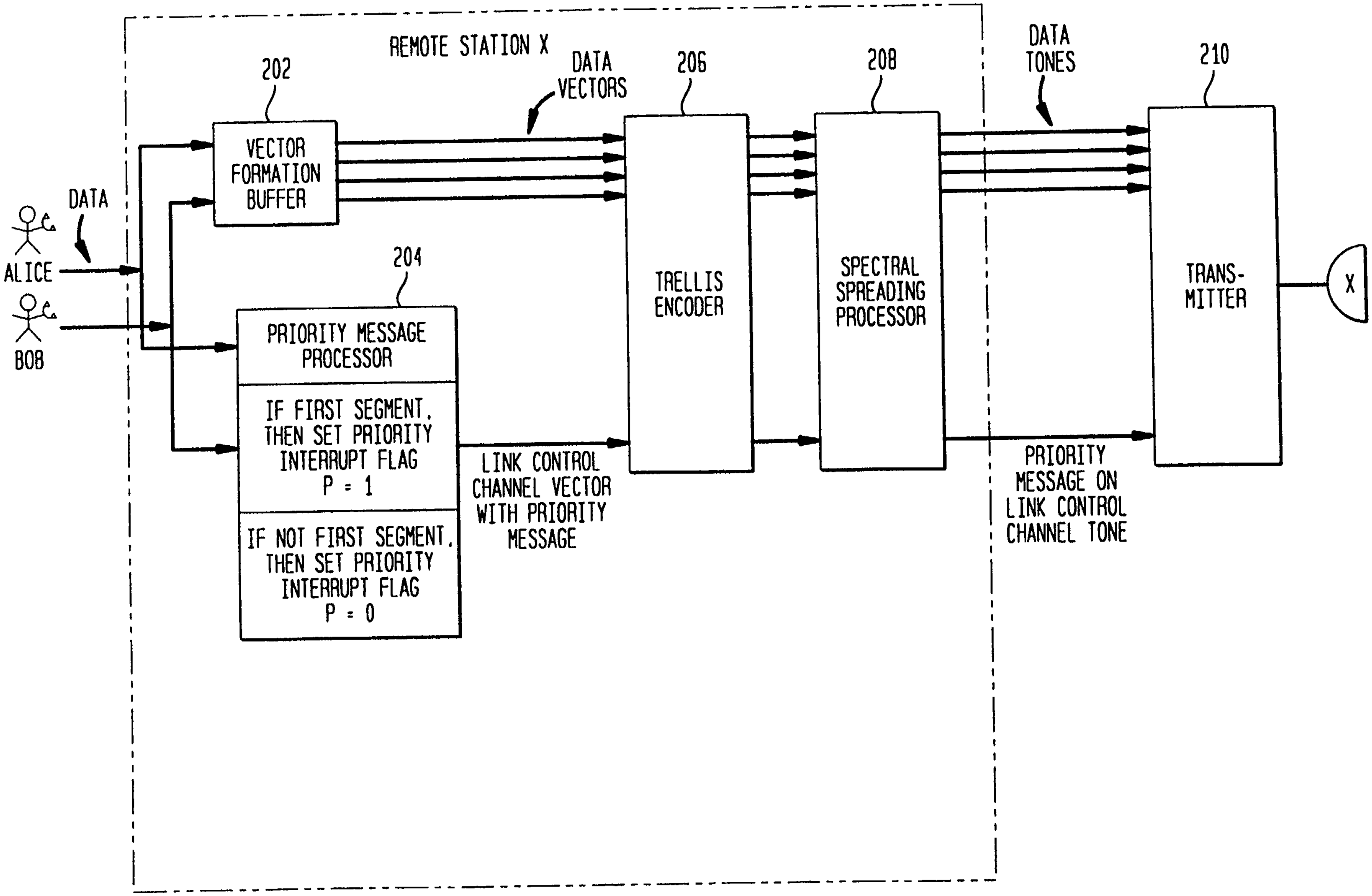

REMOTE STATION X
DATA
ALICE
BOB
202
VECTOR FORMATION BUFFER
204
PRIORITY MESSAGE PROCESSOR
IF FIRST SEGMENT, THEN SET PRIORITY INTERRUPT FLAG P = 1
IF NOT FIRST SEGMENT, THEN SET PRIORITY INTERRUPT FLAG P = 0
DATA VECTORS
LINK CONTROL CHANNEL VECTOR WITH PRIORITY MESSAGE
206
TRELLIS ENCODER
208
SPECTRAL SPREADING PROCESSOR
DATA TONES
PRIORITY MESSAGE ON LINK CONTROL CHANNEL TONE
210
TRANS-MITTER
X

FIG. 91

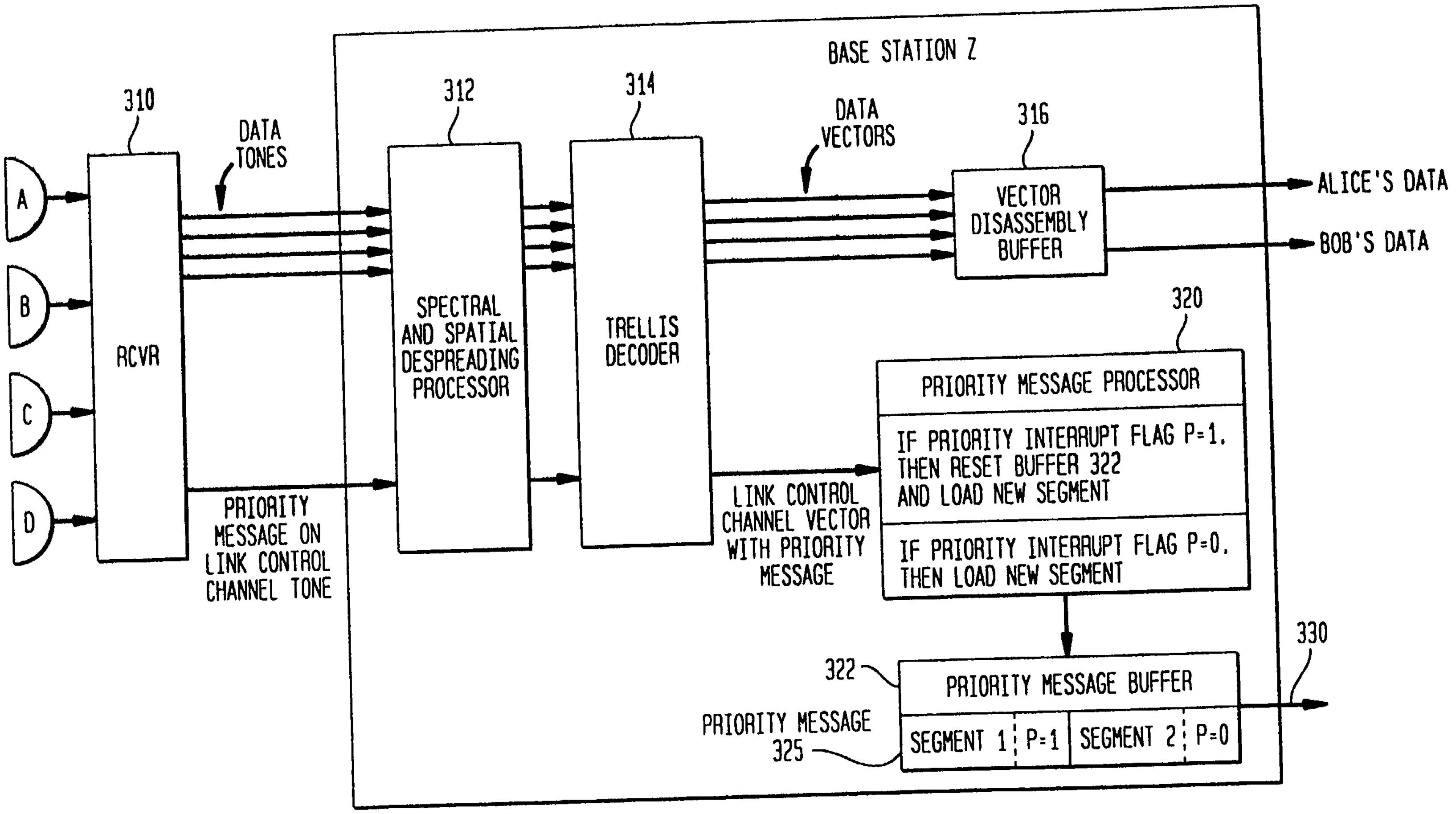
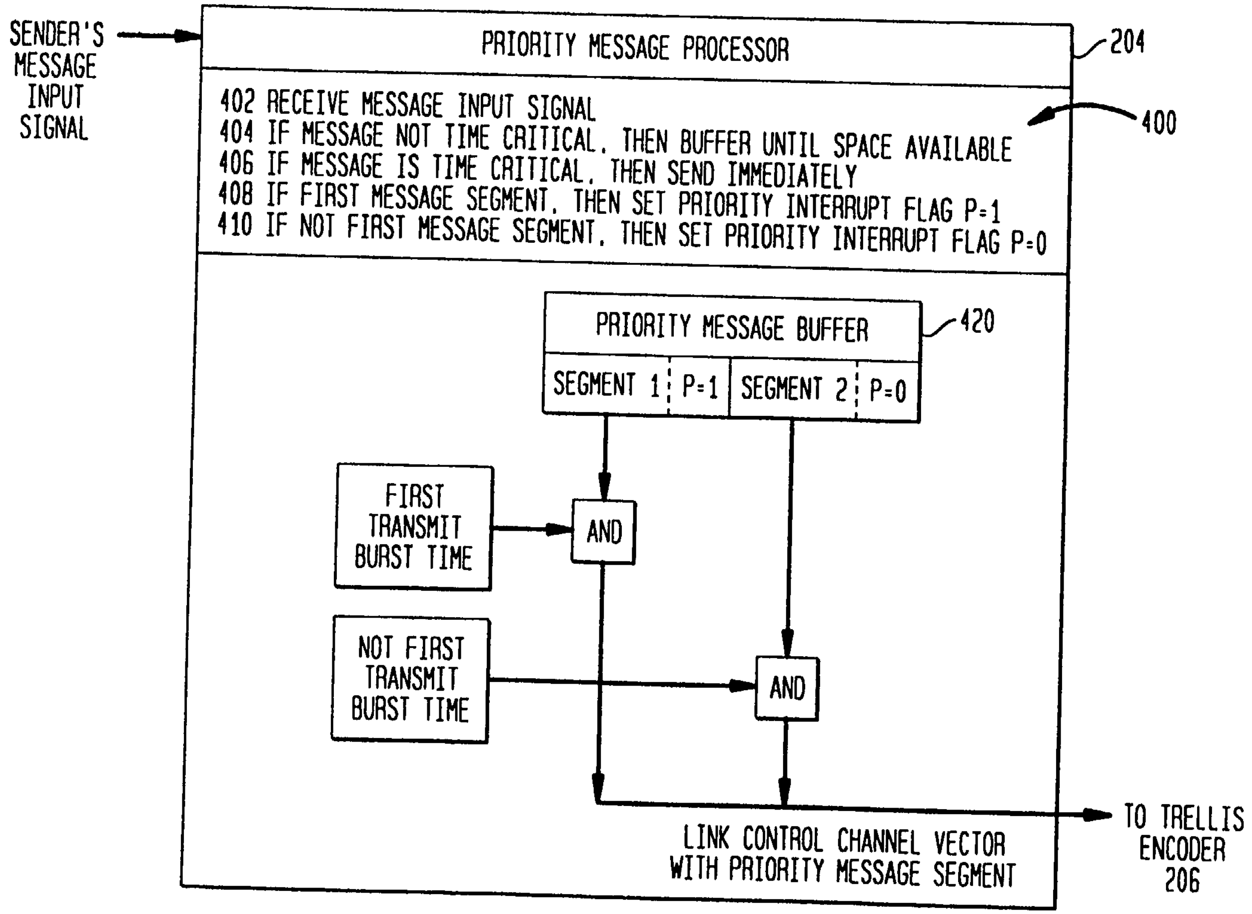

BASE STATION Z
310
RCVR
A
B
C
D
DATA TONES
PRIORITY MESSAGE ON LINK CONTROL CHANNEL TONE
312
SPECTRAL AND SPATIAL DESPREADING PROCESSOR
314
TRELLIS DECODER
DATA VECTORS
316
VECTOR DISASSEMBLY BUFFER
ALICE'S DATA
BOB'S DATA
LINK CONTROL CHANNEL VECTOR WITH PRIORITY MESSAGE
320
PRIORITY MESSAGE PROCESSOR
IF PRIORITY INTERRUPT FLAG P=1, THEN RESET BUFFER 322 AND LOAD NEW SEGMENT
IF PRIORITY INTERRUPT FLAG P=0, THEN LOAD NEW SEGMENT
322
PRIORITY MESSAGE BUFFER
SEGMENT 1
P=1
SEGMENT 2
P=0
PRIORITY MESSAGE 325
330

FIG. 92



402 RECEIVE MESSAGE INPUT SIGNAL
404 IF MESSAGE NOT TIME CRITICAL, THEN BUFFER UNTIL SPACE AVAILABLE
406 IF MESSAGE IS TIME CRITICAL, THEN SEND IMMEDIATELY
408 IF FIRST MESSAGE SEGMENT, THEN SET PRIORITY INTERRUPT FLAG P=1
410 IF NOT FIRST MESSAGE SEGMENT, THEN SET PRIORITY INTERRUPT FLAG P=0

FIG. 93

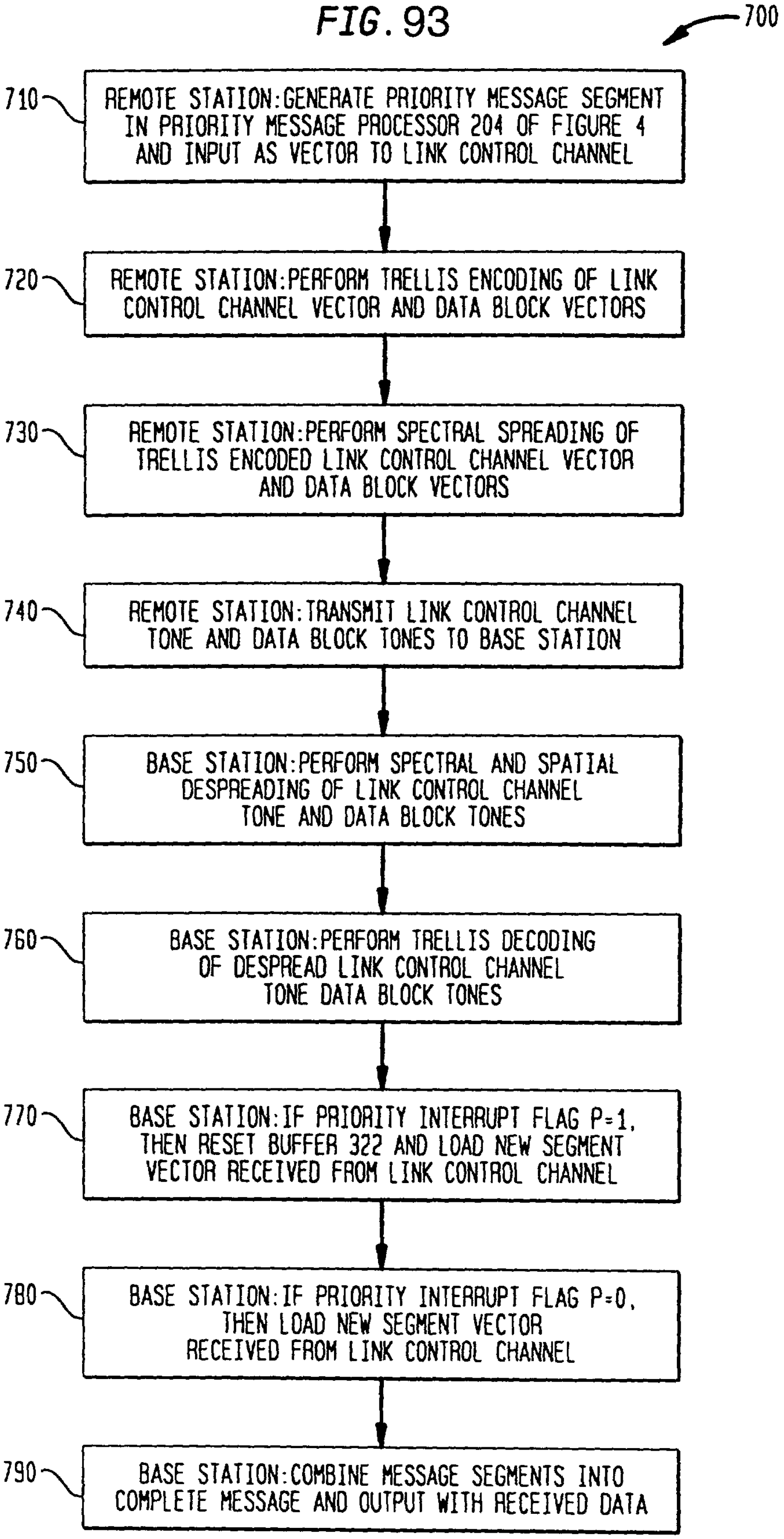
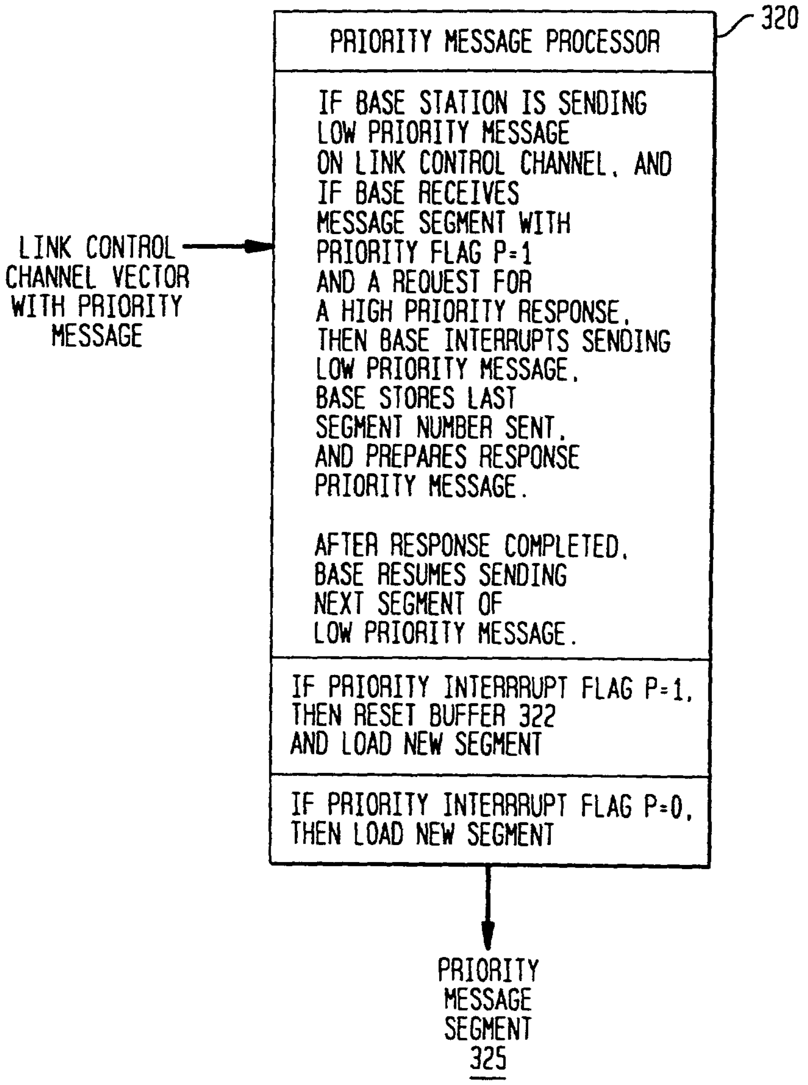

700
710
REMOTE STATION: GENERATE PRIORITY MESSAGE SEGMENT IN PRIORITY MESSAGE PROCESSOR 204 OF FIGURE 4 AND INPUT AS VECTOR TO LINK CONTROL CHANNEL
720
REMOTE STATION: PERFORM TRELLIS ENCODING OF LINK CONTROL CHANNEL VECTOR AND DATA BLOCK VECTORS
730
REMOTE STATION: PERFORM SPECTRAL SPREADING OF TRELLIS ENCODED LINK CONTROL CHANNEL VECTOR AND DATA BLOCK VECTORS
740
REMOTE STATION: TRANSMIT LINK CONTROL CHANNEL TONE AND DATA BLOCK TONES TO BASE STATION
750
BASE STATION: PERFORM SPECTRAL AND SPATIAL DESPREADING OF LINK CONTROL CHANNEL TONE AND DATA BLOCK TONES
760
BASE STATION: PERFORM TRELLIS DECODING OF DESPREAD LINK CONTROL CHANNEL TONE DATA BLOCK TONES
770
BASE STATION: IF PRIORITY INTERRUPT FLAG P=1, THEN RESET BUFFER 322 AND LOAD NEW SEGMENT VECTOR RECEIVED FROM LINK CONTROL CHANNEL
780
BASE STATION: IF PRIORITY INTERRUPT FLAG P=0, THEN LOAD NEW SEGMENT VECTOR RECEIVED FROM LINK CONTROL CHANNEL
790
BASE STATION: COMBINE MESSAGE SEGMENTS INTO COMPLETE MESSAGE AND OUTPUT WITH RECEIVED DATA

FIG. 94



IF BASE STATION IS SENDING LOW PRIORITY MESSAGE ON LINK CONTROL CHANNEL, AND IF BASE RECEIVES MESSAGE SEGMENT WITH PRIORITY FLAG P=1 AND A REQUEST FOR A HIGH PRIORITY RESPONSE, THEN BASE INTERRUPTS SENDING LOW PRIORITY MESSAGE. BASE STORES LAST SEGMENT NUMBER SENT, AND PREPARES RESPONSE PRIORITY MESSAGE.

AFTER RESPONSE COMPLETED, BASE RESUMES SENDING NEXT SEGMENT OF LOW PRIORITY MESSAGE.

IF PRIORITY INTERRRUPT FLAG P=1, THEN RESET BUFFER 322 AND LOAD NEW SEGMENT

IF PRIORITY INTERRRUPT FLAG P=0, THEN LOAD NEW SEGMENT

FIG. 95

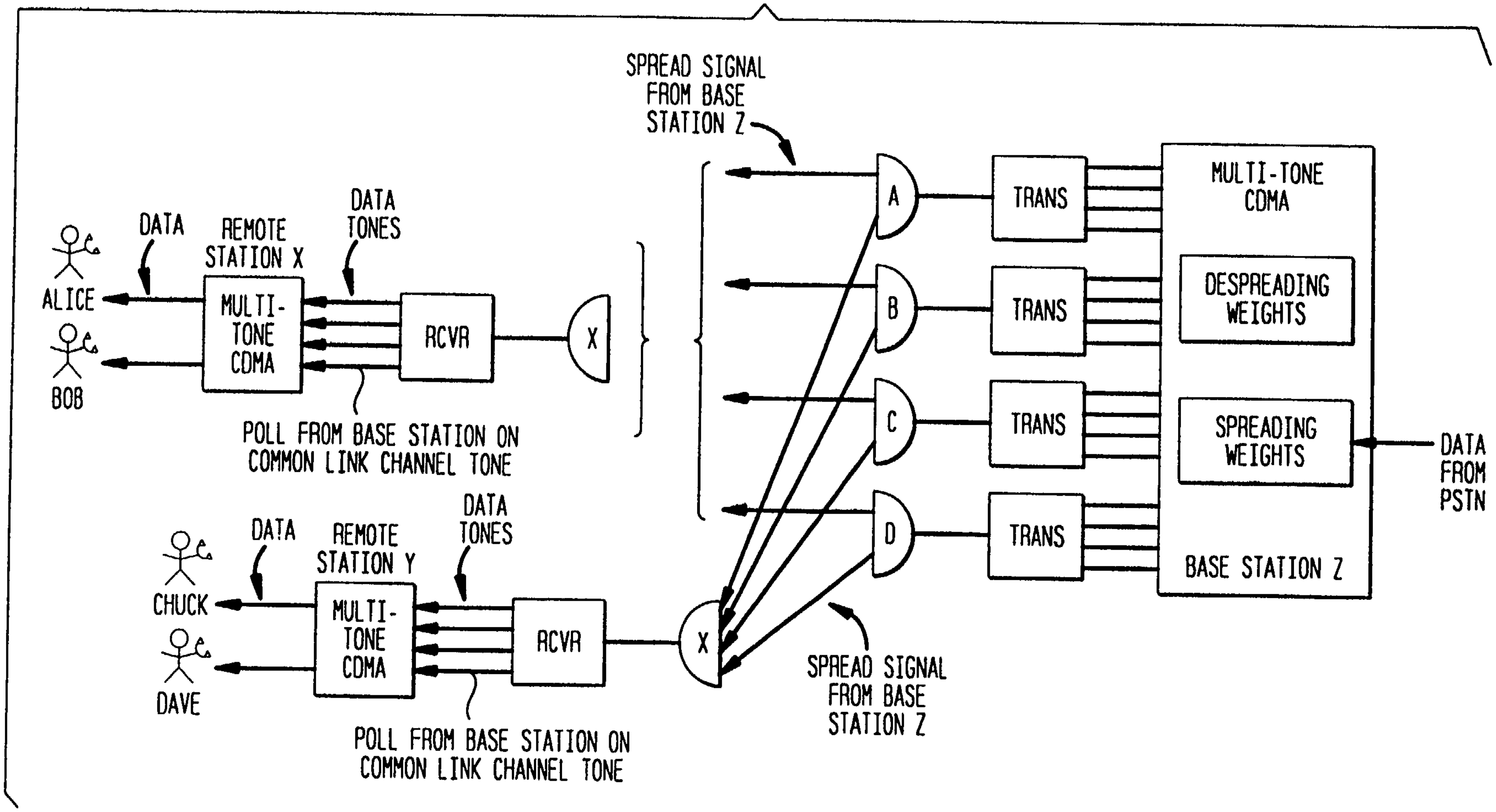

SPREAD SIGNAL FROM BASE STATION Z
DATA
REMOTE STATION X
DATA TONES
ALICE
BOB
MULTI-TONE CDMA
RCVR
X
POLL FROM BASE STATION ON COMMON LINK CHANNEL TONE
A
B
C
D
TRANS
TRANS
TRANS
TRANS
MULTI-TONE CDMA
DESPREADING WEIGHTS
SPREADING WEIGHTS
BASE STATION Z
DATA FROM PSTN
DATA
REMOTE STATION Y
DATA TONES
CHUCK
DAVE
MULTI-TONE CDMA
RCVR
X
POLL FROM BASE STATION ON COMMON LINK CHANNEL TONE
SPREAD SIGNAL FROM BASE STATION Z

FIG. 96

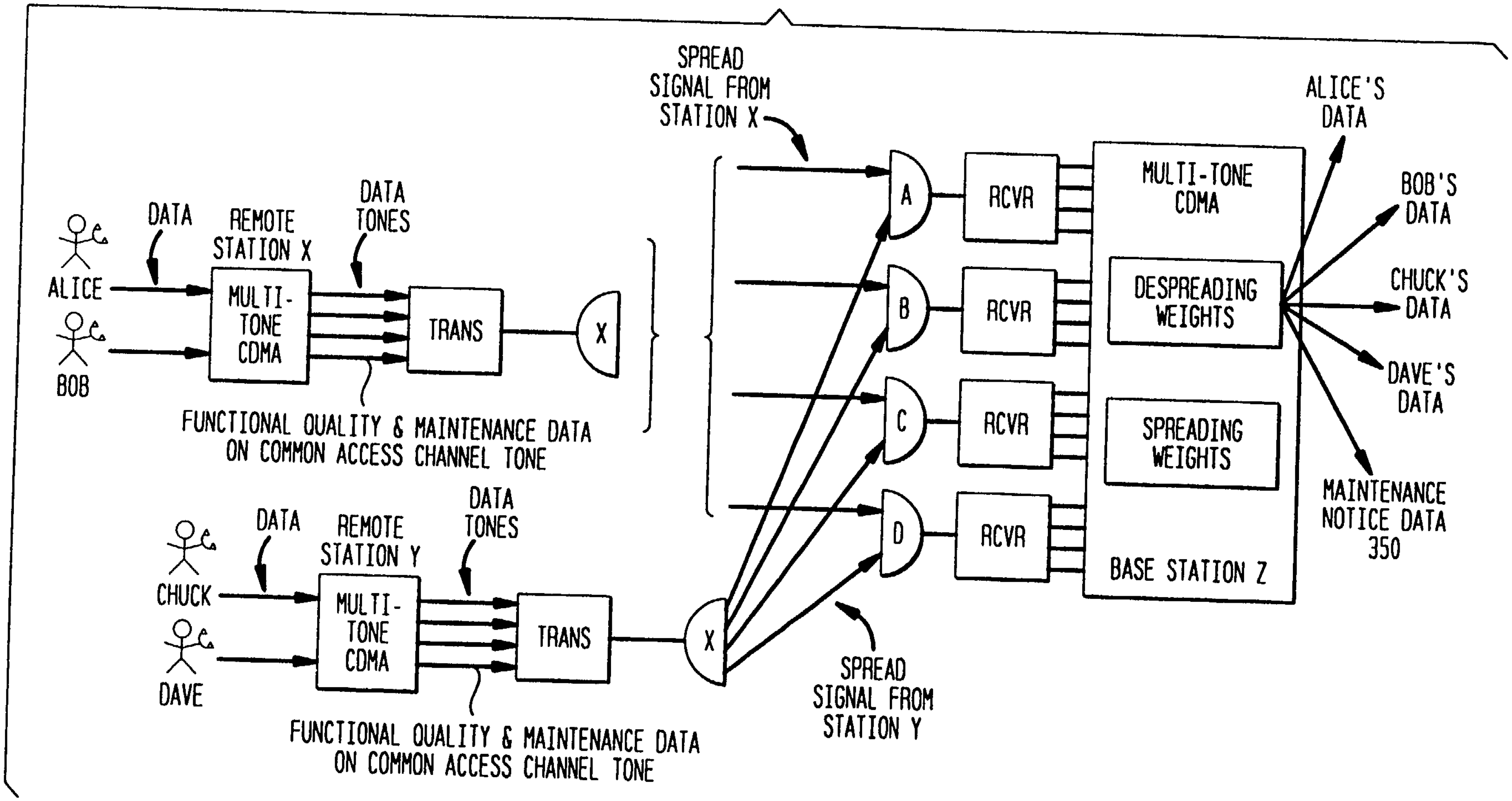

ALICE
BOB
DATA
REMOTE STATION X
MULTI-TONE CDMA
DATA TONES
TRANS
X
FUNCTIONAL QUALITY & MAINTENANCE DATA ON COMMON ACCESS CHANNEL TONE
CHUCK
DAVE
DATA
REMOTE STATION Y
MULTI-TONE CDMA
DATA TONES
TRANS
X
FUNCTIONAL QUALITY & MAINTENANCE DATA ON COMMON ACCESS CHANNEL TONE
SPREAD SIGNAL FROM STATION X
SPREAD SIGNAL FROM STATION Y
A
B
C
D
RCVR
RCVR
RCVR
RCVR
MULTI-TONE CDMA
DESPREADING WEIGHTS
SPREADING WEIGHTS
BASE STATION Z
ALICE'S DATA
BOB'S DATA
CHUCK'S DATA
DAVE'S DATA
MAINTENANCE NOTICE DATA 350

FIG. 97

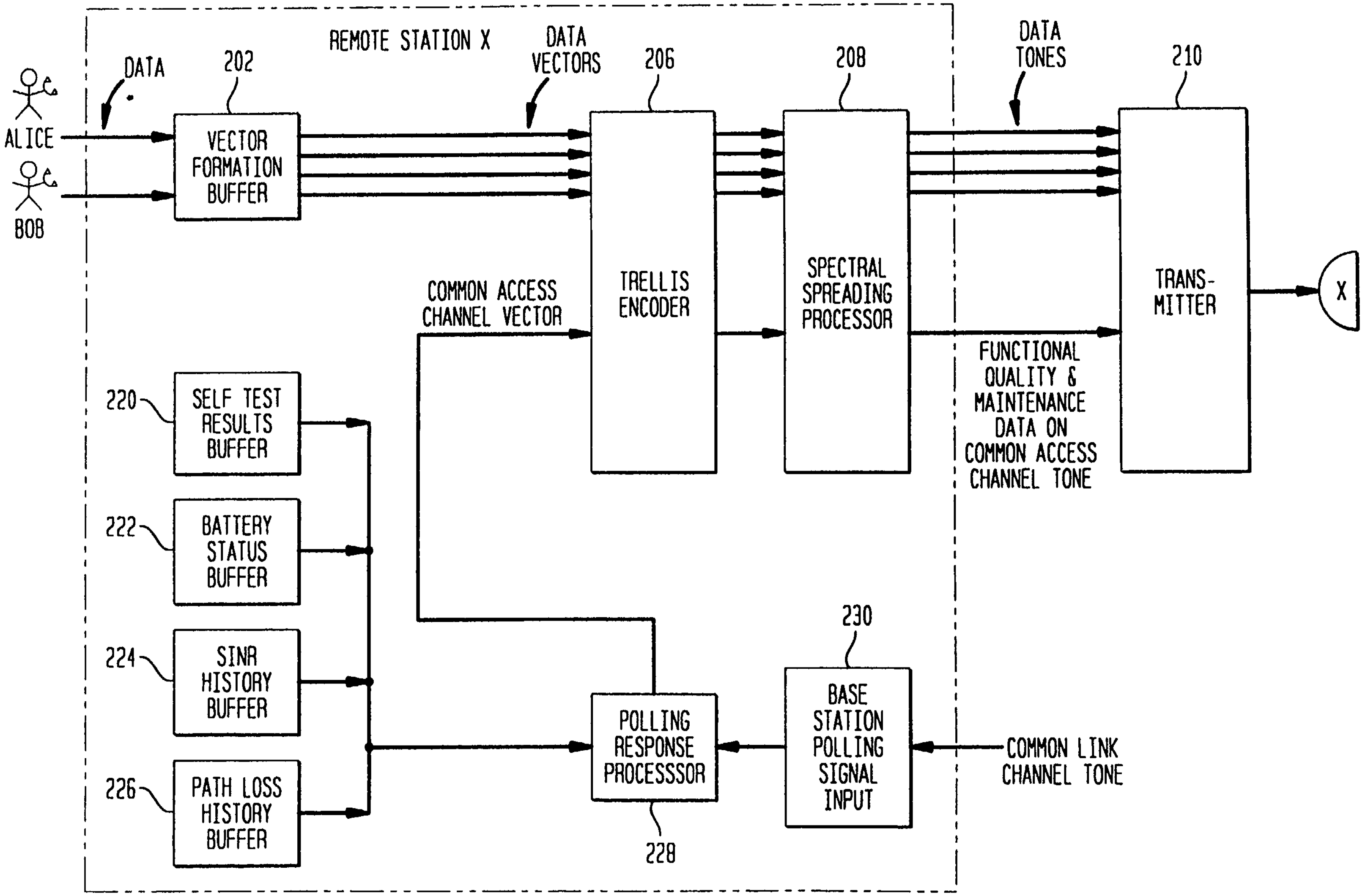

REMOTE STATION X
ALICE
BOB
DATA
202
VECTOR FORMATION BUFFER
DATA VECTORS
206
TRELLIS ENCODER
208
SPECTRAL SPREADING PROCESSOR
DATA TONES
210
TRANS-MITTER
X
COMMON ACCESS CHANNEL VECTOR
FUNCTIONAL QUALITY & MAINTENANCE DATA ON COMMON ACCESS CHANNEL TONE
220
SELF TEST RESULTS BUFFER
222
BATTERY STATUS BUFFER
224
SINR HISTORY BUFFER
226
PATH LOSS HISTORY BUFFER
228
POLLING RESPONSE PROCESSSOR
230
BASE STATION POLLING SIGNAL INPUT
COMMON LINK CHANNEL TONE

FIG. 98

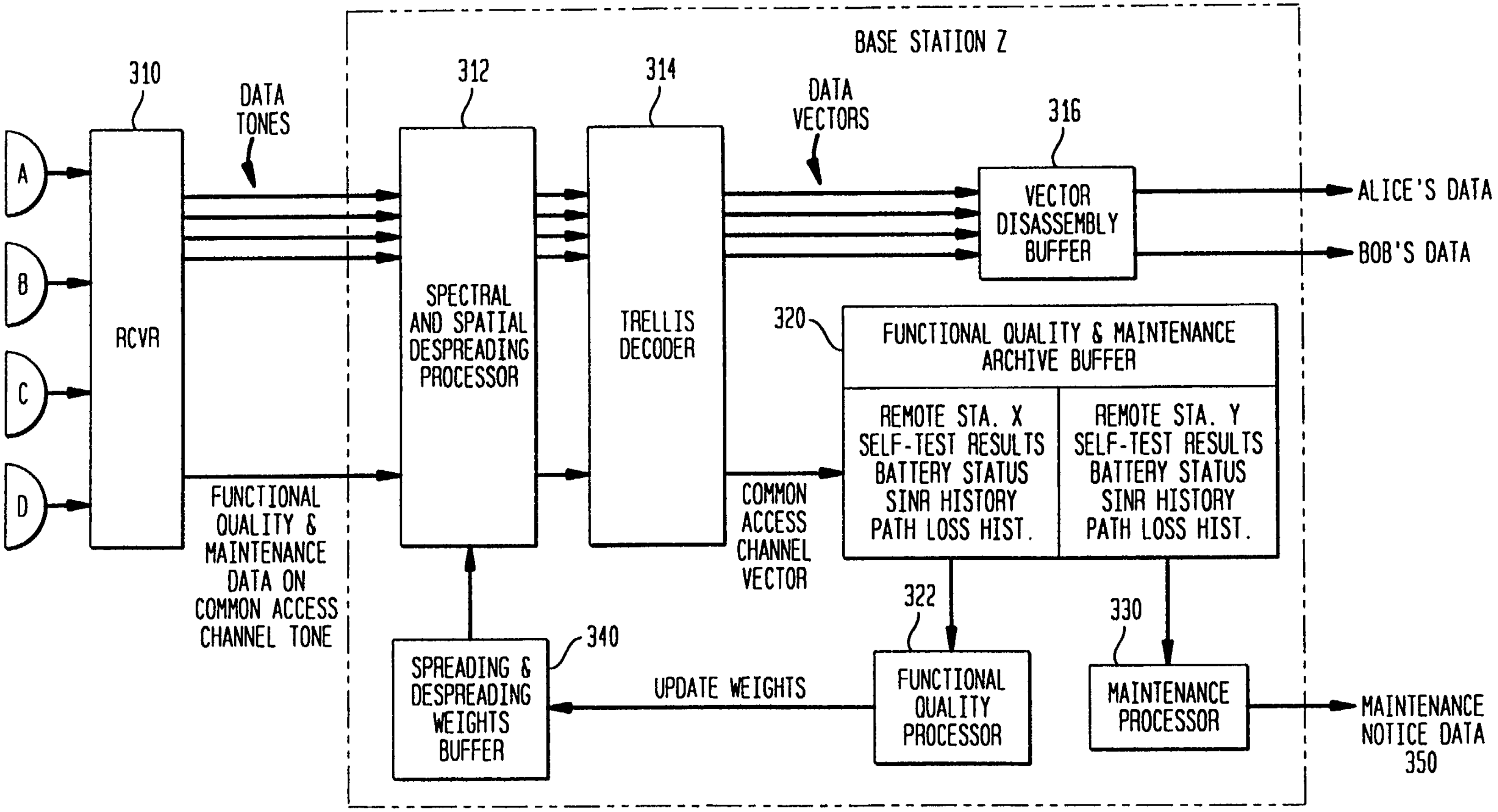

BASE STATION Z
310
RCVR
A
B
C
D
DATA TONES
FUNCTIONAL QUALITY & MAINTENANCE DATA ON COMMON ACCESS CHANNEL TONE
312
SPECTRAL AND SPATIAL DESPREADING PROCESSOR
314
TRELLIS DECODER
DATA VECTORS
COMMON ACCESS CHANNEL VECTOR
316
VECTOR DISASSEMBLY BUFFER
ALICE'S DATA
BOB'S DATA
320
FUNCTIONAL QUALITY & MAINTENANCE ARCHIVE BUFFER
REMOTE STA. X SELF-TEST RESULTS BATTERY STATUS SINR HISTORY PATH LOSS HIST.
REMOTE STA. Y SELF-TEST RESULTS BATTERY STATUS SINR HISTORY PATH LOSS HIST.
322
FUNCTIONAL QUALITY PROCESSOR
330
MAINTENANCE PROCESSOR
MAINTENANCE NOTICE DATA 350
UPDATE WEIGHTS
340
SPREADING & DESPREADING WEIGHTS BUFFER

FIG. 99

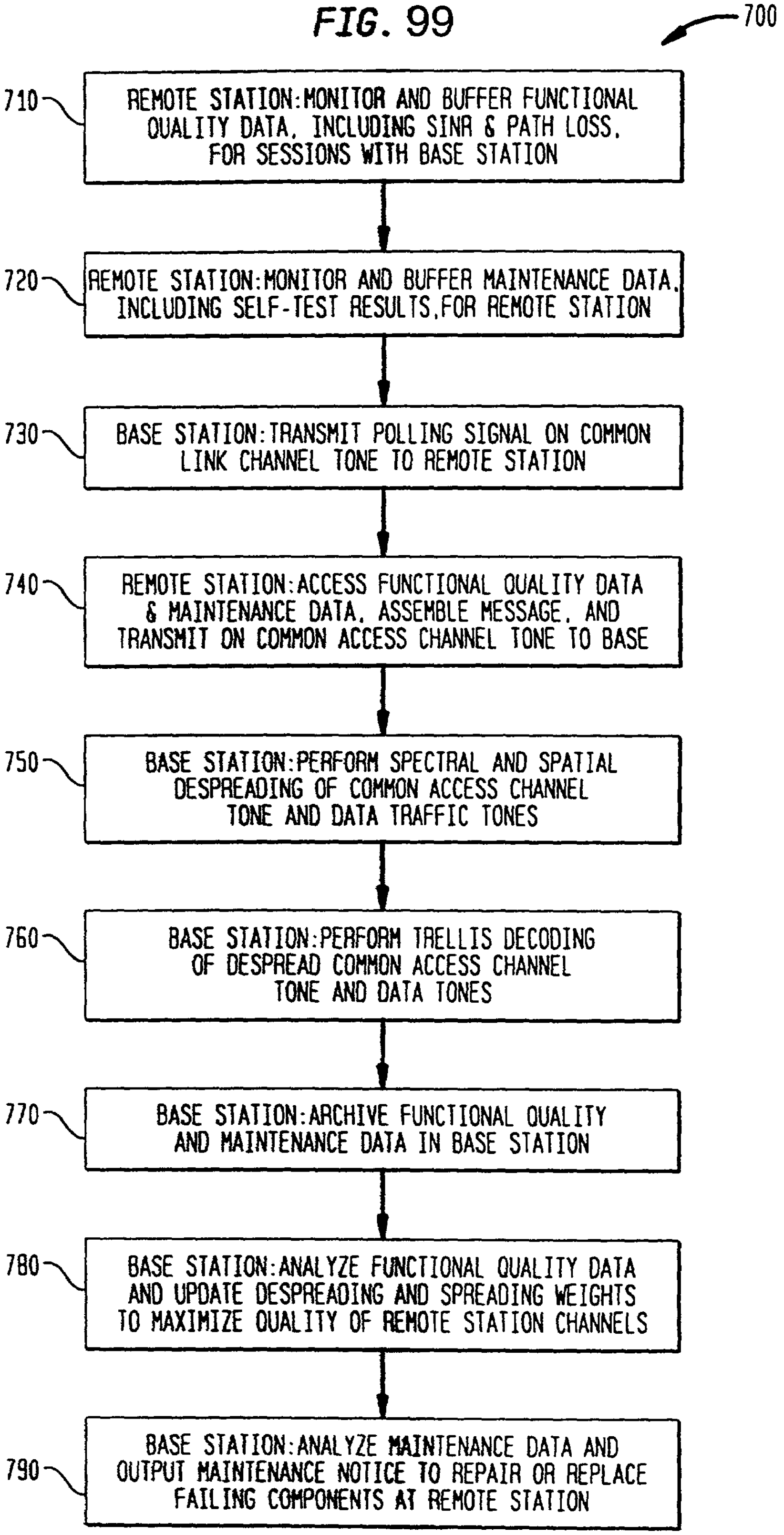

700
710
REMOTE STATION:MONITOR AND BUFFER FUNCTIONAL QUALITY DATA, INCLUDING SINR & PATH LOSS, FOR SESSIONS WITH BASE STATION
720
REMOTE STATION:MONITOR AND BUFFER MAINTENANCE DATA, INCLUDING SELF-TEST RESULTS,FOR REMOTE STATION
730
BASE STATION:TRANSMIT POLLING SIGNAL ON COMMON LINK CHANNEL TONE TO REMOTE STATION
740
REMOTE STATION:ACCESS FUNCTIONAL QUALITY DATA & MAINTENANCE DATA, ASSEMBLE MESSAGE, AND TRANSMIT ON COMMON ACCESS CHANNEL TONE TO BASE
750
BASE STATION:PERFORM SPECTRAL AND SPATIAL DESPREADING OF COMMON ACCESS CHANNEL TONE AND DATA TRAFFIC TONES
760
BASE STATION:PERFORM TRELLIS DECODING OF DESPREAD COMMON ACCESS CHANNEL TONE AND DATA TONES
770
BASE STATION:ARCHIVE FUNCTIONAL QUALITY AND MAINTENANCE DATA IN BASE STATION
780
BASE STATION:ANALYZE FUNCTIONAL QUALITY DATA AND UPDATE DESPREADING AND SPREADING WEIGHTS TO MAXIMIZE QUALITY OF REMOTE STATION CHANNELS
790
BASE STATION:ANALYZE MAINTENANCE DATA AND OUTPUT MAINTENANCE NOTICE TO REPAIR OR REPLACE FAILING COMPONENTS AT REMOTE STATION

FIG. 100

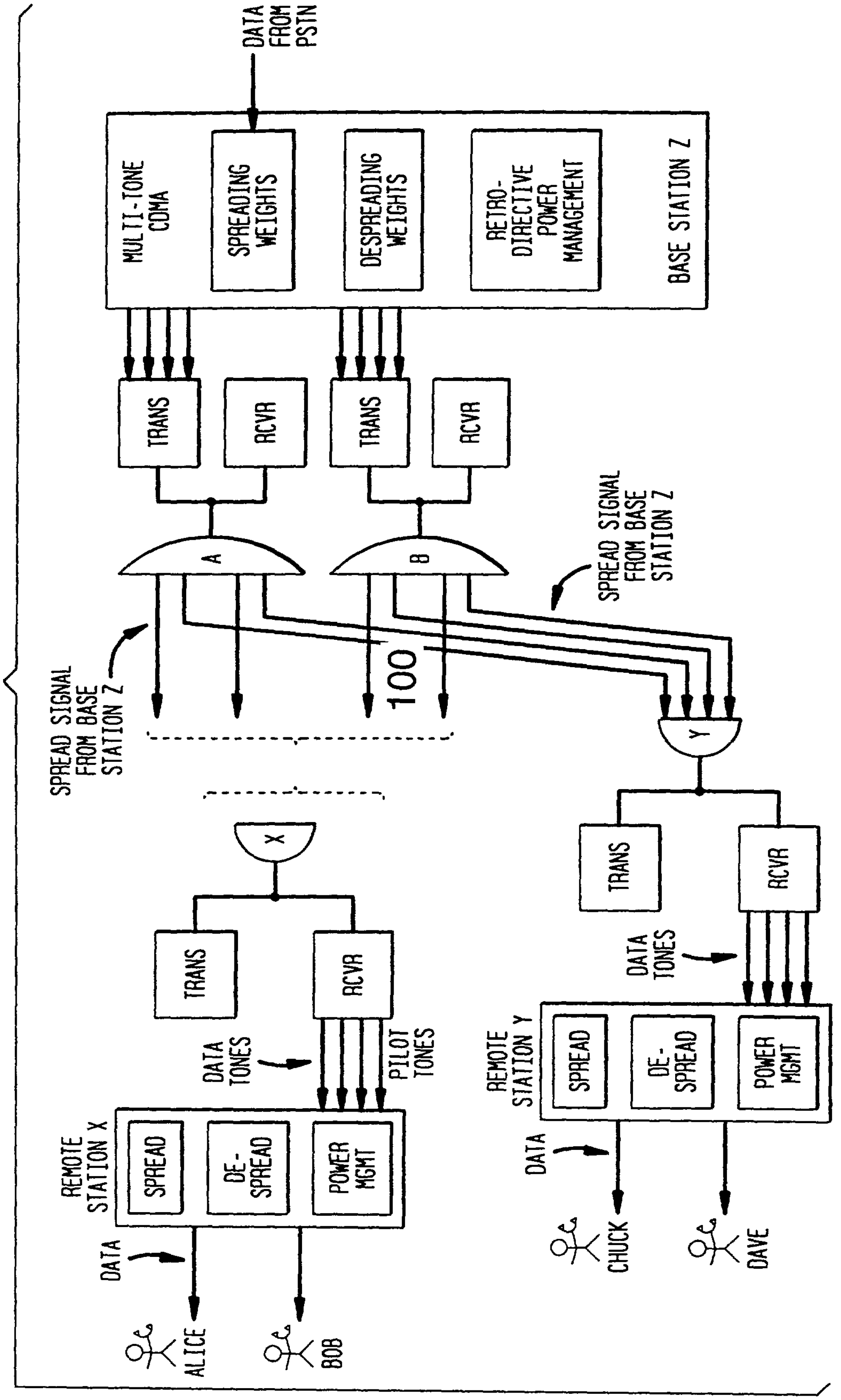

DATA FROM PSTN
MULTI-TONE CDMA
SPREADING WEIGHTS
DESPREADING WEIGHTS
RETRO-DIRECTIVE POWER MANAGEMENT
BASE STATION Z
TRANS
RCVR
TRANS
RCVR
A
B
SPREAD SIGNAL FROM BASE STATION Z
SPREAD SIGNAL FROM BASE STATION Z
100
X
Y
TRANS
RCVR
TRANS
RCVR
DATA TONES
PILOT TONES
DATA TONES
REMOTE STATION X
SPREAD
DE-SPREAD
POWER MGMT
REMOTE STATION Y
SPREAD
DE-SPREAD
POWER MGMT
DATA
DATA
ALICE
BOB
CHUCK
DAVE

FIG. 101

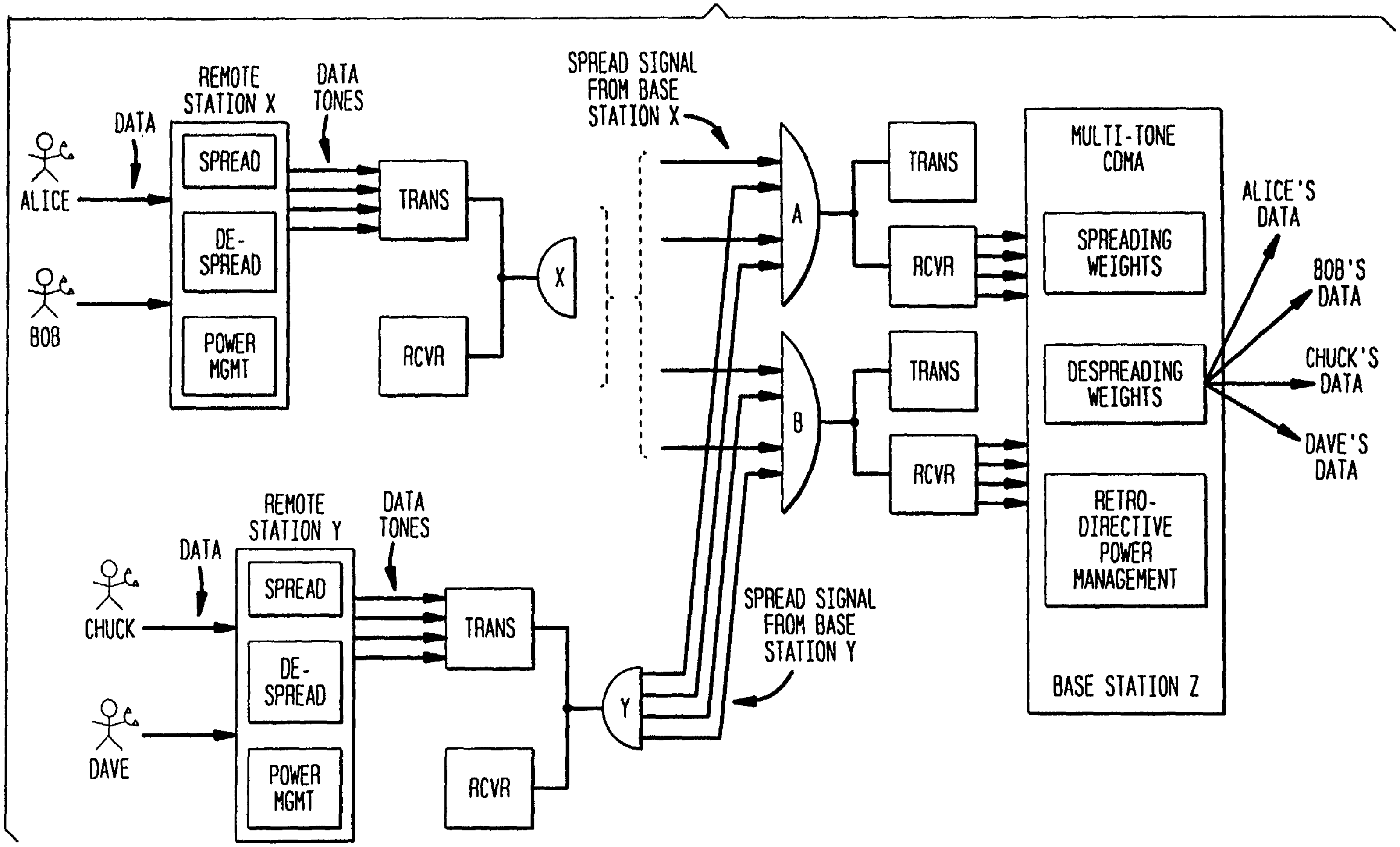

ALICE
BOB
DATA
REMOTE STATION X
SPREAD
DE-SPREAD
POWER MGMT
DATA TONES
TRANS
RCVR
X
CHUCK
DAVE
DATA
REMOTE STATION Y
SPREAD
DE-SPREAD
POWER MGMT
DATA TONES
TRANS
RCVR
Y
SPREAD SIGNAL FROM BASE STATION X
SPREAD SIGNAL FROM BASE STATION Y
A
B
TRANS
RCVR
TRANS
RCVR
MULTI-TONE CDMA
SPREADING WEIGHTS
DESPREADING WEIGHTS
RETRO-DIRECTIVE POWER MANAGEMENT
BASE STATION Z
ALICE'S DATA
BOB'S DATA
CHUCK'S DATA
DAVE'S DATA

FIG. 102

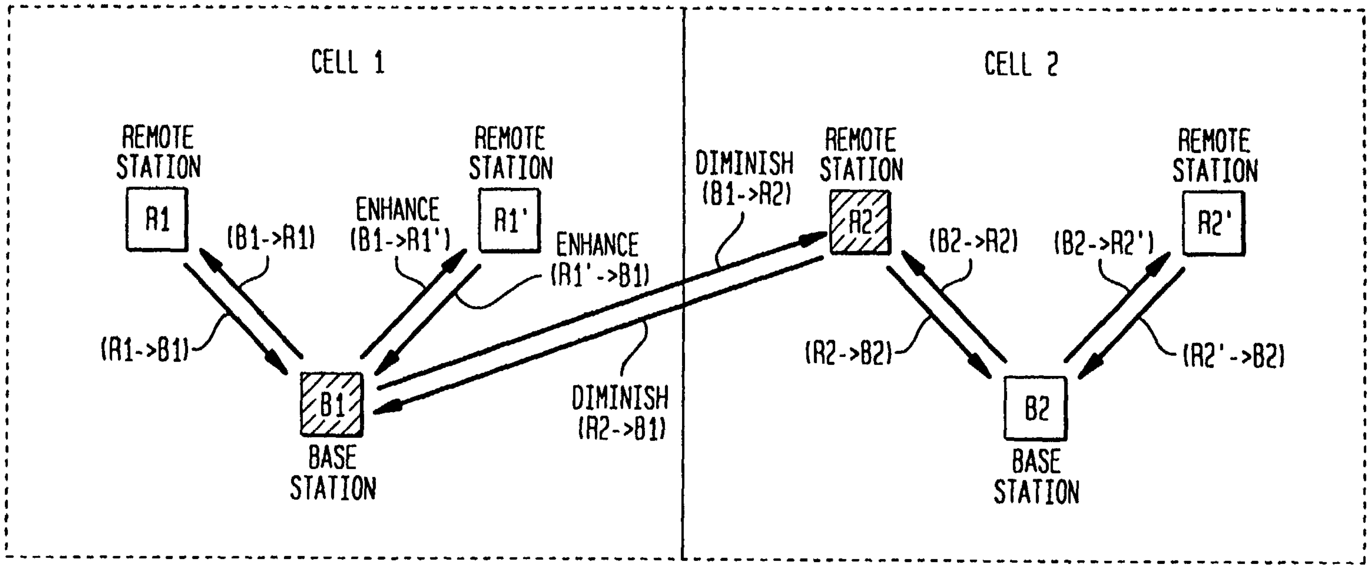
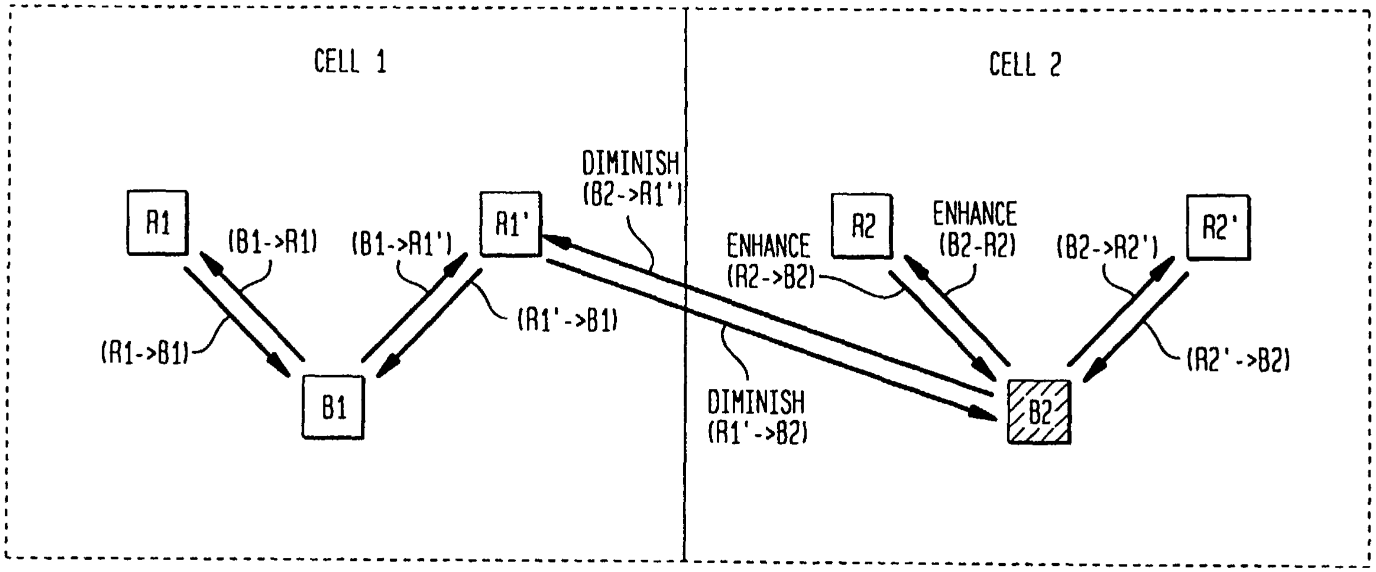

CELL 1
CELL 2
REMOTE STATION
R1
(B1->R1)
(R1->B1)
ENHANCE (B1->R1')
REMOTE STATION
R1'
ENHANCE (R1'->B1)
B1
BASE STATION
DIMINISH (B1->R2)
DIMINISH (R2->B1)
REMOTE STATION
R2
(B2->R2)
(R2->B2)
(B2->R2')
REMOTE STATION
R2'
(R2'->B2)
B2
BASE STATION

FIG. 103


CELL 1
CELL 2
R1
B1
R1'
R2
B2
R2'
(B1->R1)
(R1->B1)
(B1->R1')
(R1'->B1)
DIMINISH
(B2->R1')
DIMINISH
(R1'->B2)
ENHANCE
(R2->B2)
ENHANCE
(B2-R2)
(B2->R2')
(R2'->B2)

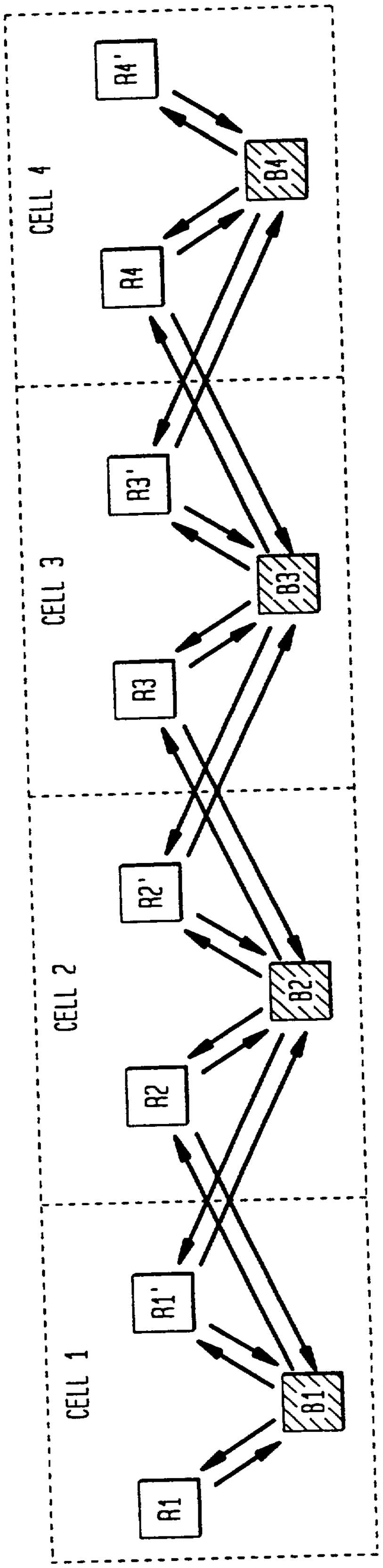


FIG. 104

FIG. 105

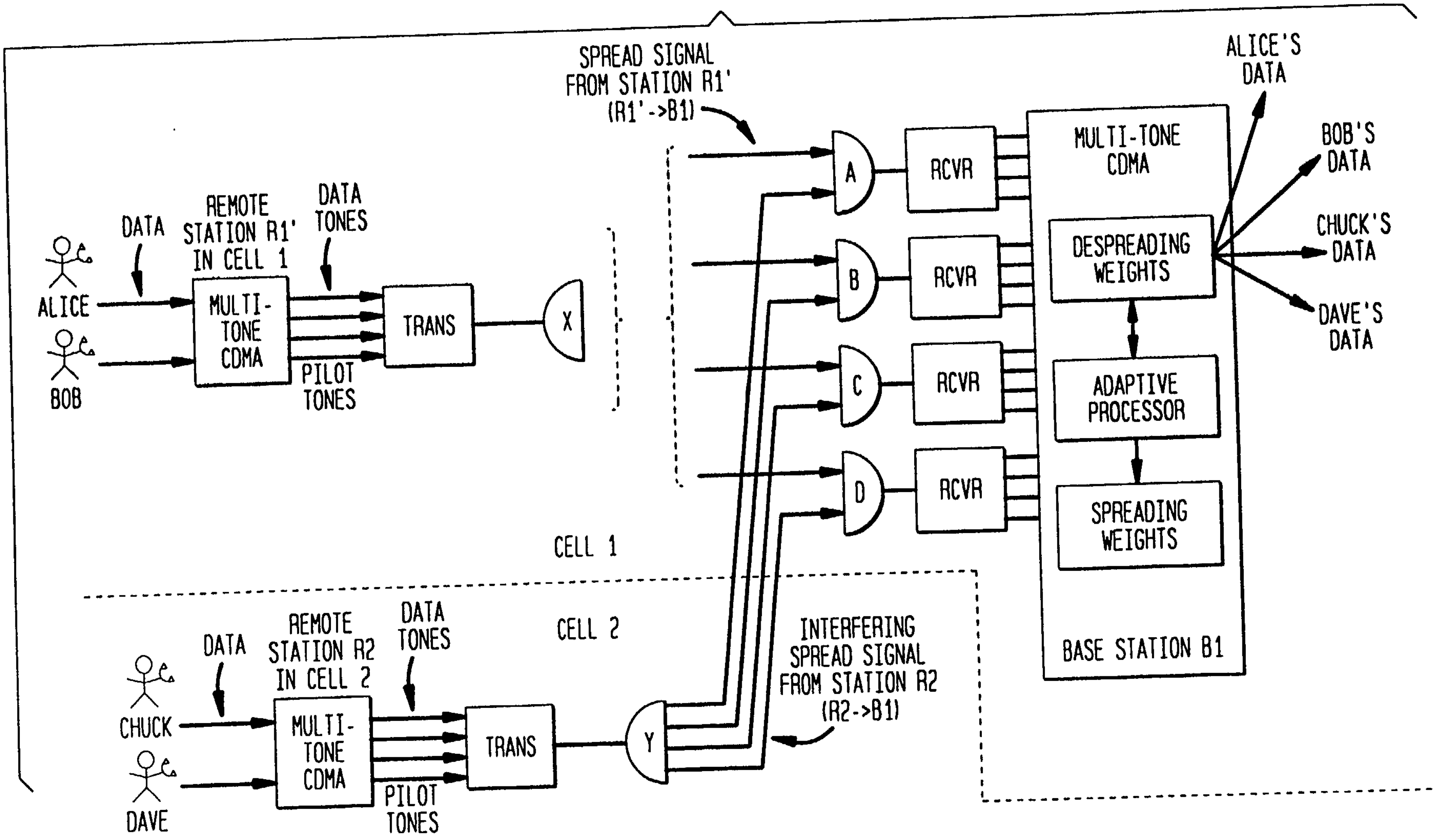
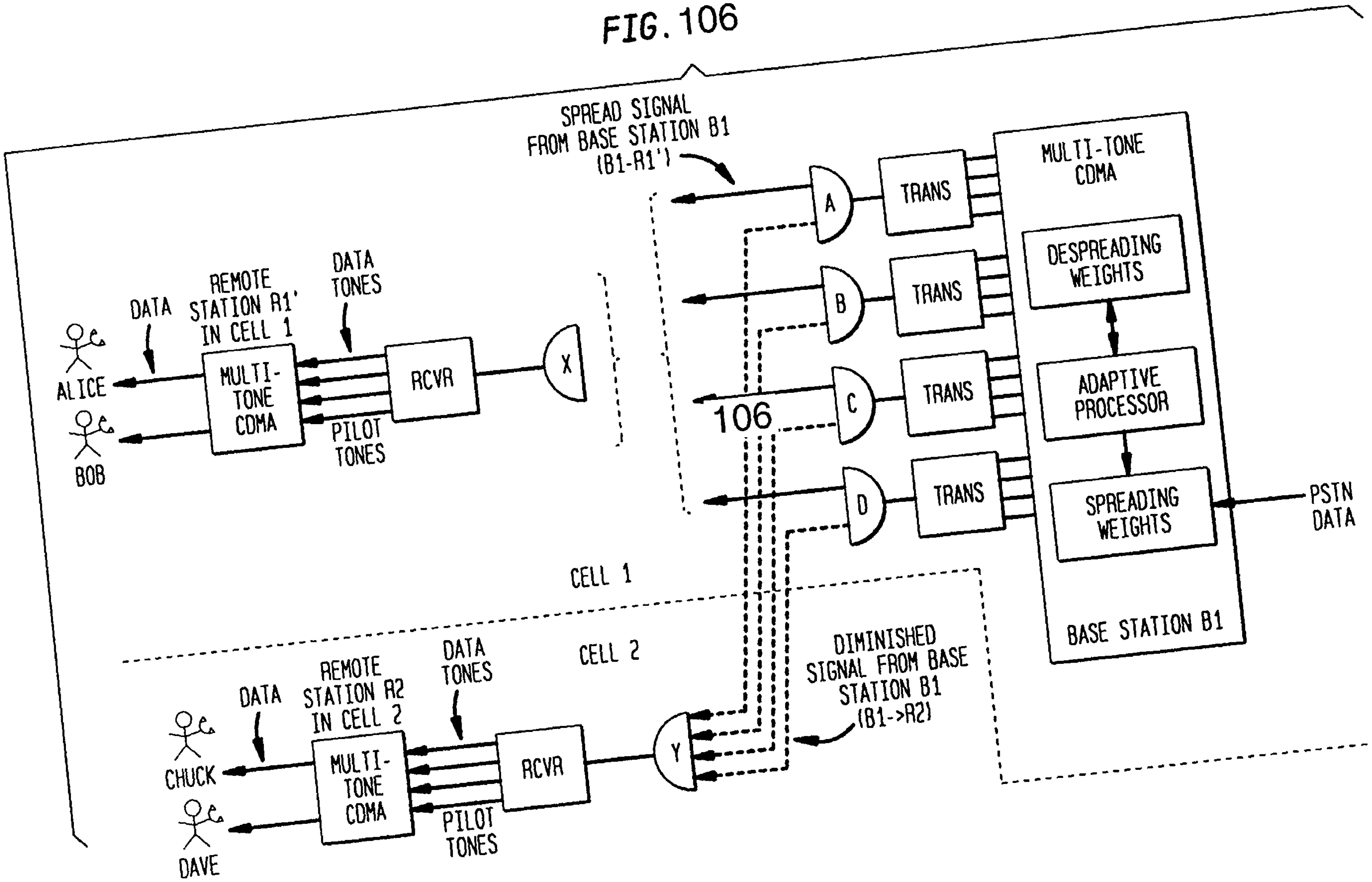

SPREAD SIGNAL FROM STATION R1' (R1'->B1)
ALICE
BOB
DATA
REMOTE STATION R1' IN CELL 1
MULTI-TONE CDMA
DATA TONES
PILOT TONES
TRANS
X
A
B
C
D
RCVR
RCVR
RCVR
RCVR
MULTI-TONE CDMA
DESPREADING WEIGHTS
ADAPTIVE PROCESSOR
SPREADING WEIGHTS
BASE STATION B1
ALICE'S DATA
BOB'S DATA
CHUCK'S DATA
DAVE'S DATA
CELL 1
CELL 2
CHUCK
DAVE
DATA
REMOTE STATION R2 IN CELL 2
MULTI-TONE CDMA
DATA TONES
PILOT TONES
TRANS
Y
INTERFERING SPREAD SIGNAL FROM STATION R2 (R2->B1)

FIG. 106


SPREAD SIGNAL
FROM BASE STATION B1
(B1-R1')
MULTI-TONE
CDMA
DESPREADING
WEIGHTS
ADAPTIVE
PROCESSOR
SPREADING
WEIGHTS
BASE STATION B1
PSTN
DATA
TRANS
TRANS
TRANS
TRANS
A
B
C
D
106
X
RCVR
DATA
TONES
PILOT
TONES
REMOTE
STATION R1'
IN CELL 1
MULTI-
TONE
CDMA
DATA
ALICE
BOB
CELL 1
CELL 2
DIMINISHED
SIGNAL FROM BASE
STATION B1
(B1->R2)
Y
RCVR
DATA
TONES
PILOT
TONES
REMOTE
STATION R2
IN CELL 2
MULTI-
TONE
CDMA
DATA
CHUCK
DAVE